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(54) ELECTROPHOTOGRAPHIC PHOTORECEPTOR, METHOD OF FORMING IMAGE, IMAGE FORMING DEVICE AND PROCESS CARTRIDGE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a photoreceptor having high wear resistance which can sufficiently and stably maintain the potential contrast in the exposed/unexposed part even under severe environmental conditions for repeated use in the electrophotographic characteristics and to provide a method of forming an image by using the above photoreceptor, an image forming device and a process cartridge to be used for the image forming device.

SOLUTION: In the electrophotographic photoreceptor having a photosensitive layer and a hardening resin layer deposited on a conductive supporting body, the difference in the ionization potential between the photosensitive layer and the hardening resin layer is ≤ 0.4 (eV) and the temporal response T10 of the electrophotographic photoreceptor is ≤ 0.25 sec.

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application converted registration]

[Date of final disposal for application]

[Patent number]

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CLAIMS

[Claim(s)]

[Claim 1] The electrophotography photo conductor characterized by for the difference of the ionization potential of this photosensitive layer and this hardenability resin layer being below 0.4 (eV), and the time-response nature T10 defined as the following of this electrophotography photo conductor being 0.25 or less seconds in the electrophotography photo conductor which comes to carry out the laminating of a photosensitive layer and the hardenability resin layer on a conductive base material.

<Time-response nature T10> Time until the ten-point average of the potential difference between the data with which the surface potential measured at intervals of after [optical irradiation] 10msec adjoins each other when optical irradiation is performed with sufficient quantity of light which can carry out optical attenuation of the photo conductor which electrified |600V|**20V below at |200V| becomes less than [10V].

[Claim 2] The electrophotography photo conductor characterized by for the difference of the ionization potential of this charge transporting bed and this hardenability resin layer being below 0.4 (eV), and the time-response nature T10 defined as the above of this electrophotography photo conductor being 0.25 or less seconds in the electrophotography photo conductor which comes to carry out the laminating of a charge generating layer, a charge transporting bed, and the hardenability resin layer on a conductive base material.

[Claim 3] The electrophotography photo conductor according to claim 1 or 2 characterized by being the siloxane system resin layer from which the aforementioned hardenability resin layer makes the organic silicon compound which has a hydroxyl group or a adding-water resolvability machine, and the compound shown by the following general formula (1) react, and is obtained.

General formula (1) B expresses the basis of univalent [containing the structural unit which has charge transportability ability], or a multiple valued among a B-(R1-ZH) m formula, R1 expresses single bond or a divalent alkylene machine, Z expresses an oxygen atom, a sulfur atom, or NH, and m expresses the integer of 1-4.

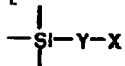
[Claim 4] The electrophotography photo conductor according to claim 3 characterized by Z in the aforementioned general formula (1) being an oxygen atom.

[Claim 5] An electrophotography photo conductor given in any 1 term of the claims 1-4 characterized by the aforementioned hardenability resin layer being a siloxane system resin layer which has the structure of cross linkage including the structural unit which has charge transportability.

[Claim 6] The electrophotography photo conductor according to claim 5 with which the aforementioned siloxane system resin layer is characterized by having the substructure expressed with the following general formula (2) in a siloxane system resin layer.

General formula (2)

[Formula 1]



(The structural unit and Y in which X has charge transportability ability express the arbitrary connection machines more than divalent among a formula, and Si expresses a silicon atom.)

[Claim 7] An electrophotography photo conductor given in any 1 term of the claims 1-6 characterized by containing colloidal silica or a metallic-oxide particle in the aforementioned hardenability resin layer.

[Claim 8] An electrophotography photo conductor given in any 1 term of the claims 1-7 characterized by containing an antioxidant in the aforementioned hardenability resin layer.

[Claim 9] An electrophotography photo conductor given in any 1 term of the claims 1-8 characterized by the aforementioned hardenability resin layer being a protective layer of this electrophotography photo conductor.

[Claim 10] The electrophotography photo conductor according to claim 1 by which it is being [the total thickness of the aforementioned photosensitive layer and the aforementioned hardenability resin layer is 15 micrometers or less, and / the time-response nature T10 / 0.1 or less seconds] characterized.

[Claim 11] The image formation method characterized by spot area carrying out latent-image formation for the image exposure in the aforementioned image exposure process to any 1 term of claims 1-10 using two or less 2000-micrometer beam light, using the electrophotography photo conductor of a publication in the image formation method of having each process of electrification, image exposure, development, and blade cleaning at least.

[Claim 12] The image formation method according to claim 11 that spot area of the aforementioned beam light is characterized by 1000-micrometer being two or less.

[Claim 13] The image formation method characterized by the mean particle diameter of the toner used for the aforementioned development process being 3-8 micrometers in the image formation method of having each process of electrification, image exposure, development, and blade cleaning at least, using an electrophotography photo conductor given in any 1 term of claims 1-10.

[Claim 14] The image formation method according to claim 13 that the rate of the toner which has the shape factor of the aforementioned toner in or more 1.0 1.6 or less range is characterized by 65-piece being several % or more.

[Claim 15] The image formation method according to claim 13 or 14 characterized by spot area performing latent-image formation for the image exposure in an image exposure process using two or less 2000-micrometer beam light.

[Claim 16] The image formation method characterized by the time from the aforementioned image exposure process to a development process carrying out image formation to any 1 term of claims 1-10 at the speed of 100 or less msec, using the electrophotography photo conductor of a publication in the image formation method of having each process of electrification, image exposure, development, and blade cleaning at least.

[Claim 17] Image formation equipment characterized by spot area carrying out latent-image formation for the image exposure in the aforementioned image exposure means to any 1 term of claims 1-10 using two or less 2000-micrometer beam light, using the electrophotography photo conductor of a publication in the image formation equipment which has each means of electrification, image exposure, development, and blade cleaning at least.

[Claim 18] Image formation equipment characterized by the mean particle diameter of the toner used for the aforementioned development means being 3-8 micrometers in the image formation equipment which has each means of electrification, image exposure, development, and blade cleaning at least, using an electrophotography photo conductor given in any 1 term of claims 1-10.

[Claim 19] Image formation equipment according to claim 18 with which the rate of the toner which has the shape factor of the aforementioned toner in or more 1.0 1.6 or less range is characterized by 65-piece being several % or more.

[Claim 20] Image formation equipment according to claim 18 or 19 characterized by spot area performing latent-image formation for the image exposure in an image exposure process using two or less 2000-micrometer beam light.

[Claim 21] Image formation equipment characterized by the time from the aforementioned image exposure means to a development means carrying out image formation to any 1 term of claims 1-10 at

the speed of 100 or less msec, using the electrophotography photo conductor of a publication in the image formation equipment which has each means of electrification, image exposure, development, and blade cleaning at least.

[Claim 22] The process cartridge characterized by having at one combining the photo conductor of a publication, and any one of an electrification means, an exposure means, a development means, and the cleaning meanses in any 1 term of claims 1-10, and being designed by this image formation equipment at receipts-and-payments freedom in the process cartridge used for an electrophotography photo conductor and the image formation equipment which has the means of electrification, image exposure, development, and cleaning at least.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the image formation method which used the electrophotography photo conductor and this electrophotography photo conductor, image formation equipment, and a process cartridge.

[0002]

[Description of the Prior Art] In recent years, the organic photo conductor is widely used for the electrophotography photo conductor. although an organic photo conductor has an advantageous point to other photo conductors -- that it is easy to develop the material corresponding to the various exposure light sources, that material without environmental pollution can be chosen, and a manufacturing cost is cheap -- from the light to infrared light -- as a fault -- a mechanical strength -- weak -- many -- there are degradation of a photo conductor front face and generating of a blemish at the time of the print of several sheets

[0003] Since electric and mechanical external force is directly applied to the front face of an electrophotography photo conductor (only henceforth a photo conductor) by the electrification means, the development means, the imprint means, the cleaning means, etc., the endurance over them is required.

[0004] The endurance over degradation of the front face by active oxygen, such as ozone specifically generated at the time of wear on the front face of a photo conductor by friction, generating of a blemish, and corona electrical charging, the Chisso oxide, etc. is required.

[0005] As approach for that, the technology of installing the protective layer of high intensity on the surface of a photo conductor has been examined. For example, although using hardenability silicone resin is reported by JP,6-118681,A as a protective layer of a photo conductor, in the damp environment which a problem is in the transportation function of the generated carrier, especially serves as high resistance, a problem arises to responsibility. Although the demand to high definition increases and the image formation of high resolution is considered in the field of the digital copier, the surface-protection layer with responsibility low in this way cannot cause diffusion of a carrier, and cannot acquire a good electrostatic latent image.

[0006] Although the potential contrast of exposure / unexposed section needs to be enough secured in order to reproduce image information faithfully as an electrostatic latent image, it is important for this to press down diffusion of a carrier until a generating carrier reaches a surface charge. the Japanese painting image society magazine volume [38th] No. 4 296 pages -- latent-image degradation of a high-density picture -- the ratio of the diffusion constant (D) of a charge transporting bed, and drift mobility (μ) -- if D/μ becomes large, the effect of the diffusion to an electrostatic latent image cannot be disregarded, but if the thickness of a charge transporting bed becomes large, it is described that latent-image degradation becomes large However, the organic electrophotography photo conductor put in practical use so far had the large thickness wear by the scratch of a cleaning blade etc., designing photosensitive-layer thickness, such as a charge transporting bed, to 20 micrometers or less will make

endurance of a photo conductor still smaller, and it was not desirable.

[0007] From the above thing, the intensity to the scratch of a cleaning blade etc. is large, and examination of the high-definition image formation method, image formation equipment, etc. using the electrophotography photo conductor which the potential contrast of exposure / unexposed section can secure enough also in damp environment, and this electrophotography photo conductor has been made.

[0008]

[Problem(s) to be Solved by the Invention] The purpose of this invention is to solve the above-mentioned trouble, its surface hardness is high, abrasion resistance is high, and also under a severe environmental condition like high-humidity/temperature and low-humidity/temperature, the electrophotography property at the time of repeat use is offering the photo conductor which the potential contrast of exposure / unexposed section can secure sufficiently stably, and is offering the process cartridge used for the image formation method and image formation equipment using this photo conductor, and this image formation equipment.

[0009]

[Means for Solving the Problem] We found out that it was effective in suppressing diffusion of the carrier of this photo conductor to make small the ionization potential difference of a this hardenability resin layer and the photosensitive layer under it, for example, a charge transporting bed, in the photo conductor which used the high hardenability resin layer of surface hardness for the protective layer, as a result of repeating examination about the above-mentioned trouble. That is, disorder of electrostatic latent-image formation was lessened by making the ionization potential difference of a hardenability resin layer and a charge transporting bed below into 0.4 (eV), and keeping the time-response nature in a photo conductor total at less than 0.25 secs, and it found out that a good picture could be formed.

[0010] That is, it found out that the purpose of this invention was attained by taking any of the following composition they are.

[0011] 1. Electrophotography photo conductor characterized by for difference of ionization potential of this photosensitive layer and this hardenability resin layer being below 0.4 (eV), and time-response nature T10 defined as the following of this electrophotography photo conductor being 0.25 or less seconds in electrophotography photo conductor which comes to carry out laminating of photosensitive layer and hardenability resin layer on conductive base material.

[0012] <Time-response nature T10> Time until the ten-point average of the potential difference between the data with which the surface potential measured at intervals of after [optical irradiation] 10msec adjoins each other when optical irradiation is performed with sufficient quantity of light which can carry out optical attenuation of the photo conductor which electrified $|600V|^{**}20V$ below at $|200V|$ becomes less than [10V].

[0013] 2. Electrophotography photo conductor characterized by for difference of ionization potential of this charge transporting bed and this hardenability resin layer being below 0.4 (eV), and time-response nature T10 defined as the above of this electrophotography photo conductor being 0.25 or less seconds in electrophotography photo conductor which comes to carry out laminating of charge generating layer, charge transporting bed, and hardenability resin layer on conductive base material.

[0014] 3. The above 1 characterized by being siloxane system resin layer from which aforementioned hardenability resin layer makes organic silicon compound which has hydroxyl group or adding-water resolvability machine, and compound shown by aforementioned account general formula (1) react, and is obtained, or electrophotography photo conductor given in 2.

[0015] 4. Electrophotography photo conductor given in the above 3 characterized by Z in aforementioned general formula (1) being oxygen atom.

[0016] 5. Electrophotography photo conductor given in any 1 term of the above 1-4 characterized by aforementioned hardenability resin layer being siloxane system resin layer which has the structure of cross linkage including structural unit which has charge transportability.

[0017] 6. Electrophotography photo conductor given in the above 5 whose aforementioned siloxane system resin layer is characterized by having substructure expressed with aforementioned general formula (2) in siloxane system resin layer.

- [0018] 7. Electrophotography photo conductor given in any 1 term of the above 1-6 characterized by containing colloidal silica or metallic-oxide particle in aforementioned hardenability resin layer.
- [0019] 8. Electrophotography photo conductor given in any 1 term of the above 1-7 characterized by containing antioxidant in aforementioned hardenability resin layer.
- [0020] 9. Electrophotography photo conductor given in any 1 term of the above 1-8 characterized by aforementioned hardenability resin layer being protective layer of this electrophotography photo conductor.
- [0021] 10. The electrophotography photo conductor of one aforementioned publication by which it is being [the total thickness of the aforementioned photosensitive layer and the aforementioned hardenability resin layer is 15 micrometers or less, and / the time-response nature $T_{10} / 0.1$ or less seconds] characterized.
- [0022] 11. The image formation method characterized by spot area carrying out latent-image formation for the image exposure in the aforementioned image exposure process to any 1 term of the above 1-10 using two or less 2000-micrometer beam light, using the electrophotography photo conductor of a publication in the image formation method of having each process of electrification, image exposure, development, and blade cleaning at least.
- [0023] 12. The image formation method of 11 aforementioned publication that spot area of the aforementioned beam light is characterized by 1000-micrometer being two or less.
- [0024] 13. The image formation method characterized by the mean particle diameter of the toner used for the aforementioned development process being 3-8 micrometers in the image formation method of having each process of electrification, image exposure, development, and blade cleaning at least, using an electrophotography photo conductor given in any 1 term of the above 1-10.
- [0025] 14. The image formation method given in the above 13 with which the rate of the toner which has the shape factor of the aforementioned toner in or more 1.0 1.6 or less range is characterized by 65-piece being several % or more.
- [0026] 15. The above 13 characterized by spot area performing latent-image formation for the image exposure in an image exposure process using two or less 2000-micrometer beam light, or the image formation method given in 14.
- [0027] 16. The image formation method characterized by the time from the aforementioned image exposure process to a development process carrying out image formation to any 1 term of the above 1-10 at the speed of 100 or less msec, using the electrophotography photo conductor of a publication in the image formation method of having each process of electrification, image exposure, development, and blade cleaning at least.
- [0028] 17. Image formation equipment characterized by spot area carrying out latent-image formation for the image exposure in the aforementioned image exposure means to any 1 term of the above 1-10 using two or less 2000-micrometer beam light, using the electrophotography photo conductor of a publication in the image formation equipment which has each means of electrification, image exposure, development, and blade cleaning at least.
- [0029] 18. Image formation equipment characterized by the mean particle diameter of the toner used for the aforementioned development means being 3-8 micrometers in the image formation equipment which has each means of electrification, image exposure, development, and blade cleaning at least, using an electrophotography photo conductor given in any 1 term of the above 1-10.
- [0030] 19. Image formation equipment given in the above 18 with which the rate of the toner which has the shape factor of the aforementioned toner in or more 1.0 1.6 or less range is characterized by 65-piece being several % or more.
- [0031] 20. The above 18 characterized by spot area performing latent-image formation for the image exposure in an image exposure process using two or less 2000-micrometer beam light, or image formation equipment given in 19.
- [0032] 21. Image formation equipment characterized by the time from the aforementioned image exposure means to a development means carrying out image formation to any 1 term of the above 1-10 at the speed of 100 or less msec, using the electrophotography photo conductor of a publication in the

image formation equipment which has each means of electrification, image exposure, development, and blade cleaning at least.

[0033] 22. The process cartridge characterized by having at one combining the photo conductor of a publication, and any one of an electrification means, an exposure means, a development means, and the cleaning means in any 1 term of the above 1-10, and being designed by this image formation equipment at receipts-and-payments freedom in the process cartridge used for an electrophotography photo conductor and the image formation equipment which has the means of electrification, image exposure, development, and cleaning at least.

[0034] Hereafter, the detail of this invention is explained. The time-response nature of this invention is explained.

[0035] The time-response nature T10 of this invention is time until the ten-point average of the potential difference between the data with which the surface potential measured at intervals of after [optical irradiation] 10msec adjoins each other becomes less than [10V], when optical irradiation is performed with sufficient quantity of light which can carry out optical attenuation of the photo conductor which electrified [600V]**20V below at [200V].

[0036] Time until the ten-point average of the potential difference between the data with which the above-mentioned surface potential adjoins each other becomes less than [10V] is made into ten data block which shifted one data of potential difference data between these next door **** data at a time in the time train serially, and means the first time when the average of ten potential difference data of this data block becomes less than [10V].

[0037] The ionization potential of this invention is explained. Although the ionization potential of this invention is the numeric value which expressed with the unit of electron-volt the energy taken to pull apart one electron from the ground state of an atom or a molecule in infinite distance generally, let fortune-telling-ed [highest] level's of the electron hole transportation matter be central value as a standard of the energy level in electron hole transportation with ionization potential here.

[0038] The shock of the measurement of the ionization potential of a hardenability resin layer can be carried out to the hardenability resin layer which produced the film by the acceleration electron or the photon, and it can be obtained by searching for the minimum energy to which the ion produced as a result of ionization appears. In this invention, ionization potential was measured using the front-face nature testing device "AC-1" (Riken Keiki Co., Ltd. make).

[0039] In order to make the difference (ΔIP) of the ionization potential of the hardenability resin layer of this invention, and a photosensitive layer below into 0.4 (eV), it is required for a hardenability resin layer to bring the ionization potential of the photosensitive layer which gives the move property of a uniform charge carrier to this whole hardenability resin layer, and adjoins on it close to the ionization potential of this hardenability resin layer. Hereafter, the method of giving charge transportability to a hardenability resin layer and the method of bringing the ionization potential of a charge transporting bed close to the ionization potential of this hardenability resin layer, and the method of bringing the ionization potential of a hardenability resin layer close to the ionization potential of a charge transporting bed are indicated further.

[0040] In process of layer formation, by energy, such as heat and light, the constituent of these resins, such as a monomer, oligomer, or polymer, promotes a chemical reaction mutually, and calls a resin layer with the high degree of hardness in which 3-dimensional bridge formation carried out structure formation the hardenability resin layer of this invention. Although melamine resin, an epoxy resin, phenol resin, the urethane resin, etc. were mentioned as a resin material of such a hardenability resin layer, in this invention, the electrophotography photo conductor of this invention was produced using the siloxane system resin layer as shown below. The electrophotography photo conductor which has this siloxane system resin layer below is indicated.

[0041] The hardenability resin layer of this invention (siloxane system resin layer containing the structural unit which has charge transportability ability)

The electrophotography photo conductor of this invention is attained by constituting the siloxane system resin layer containing the structural unit which has charge transportability ability as a protective layer of

a photosensitive layer. This siloxane system resin layer can be obtained by carrying out application dryness of the constituent of the hardenability organic silicon compound etc. and this organic silicon compound which are explained in full detail below, and the reactant charge transportability compound which has reactivity.

[0042] The aforementioned hardenability organic silicon compound is typically formed by carrying out application dryness of the application constituent which used as the raw material the organic silicon compound expressed with the following general formula (3). By hydrolysis and the condensation reaction produced after that, these raw materials form the condensate (oligomer) of an organic silicon compound in a solvent in a hydrophilic solvent. The siloxane system resin layer in which the 3-dimensional network structure was formed can be formed by applying these application constituent and drying.

[0043]

General formula (3) The organic machine of the form where the silicon atom coupled Si directly with this silicon atom among the (R) n-Si-(X)_{4-n} formula, and carbon coupled R directly is expressed, X expresses a hydroxyl group or a adding-water resolvability machine, and n expresses the integer of 0-3.

[0044] As an organic machine of the form which carbon coupled directly with the silicon shown by R in the organic silicon compound expressed with a general formula (3) Alkyl groups, such as a methyl, ethyl, a propyl, and butyl, a phenyl, tolyl, Aryl groups, such as a naphthyl and a biphenyl, gamma-glycidioxy propyl, ** epoxy groups, such as beta-(3, 4-epoxycyclohexyl) ethyl, The ** (meta) acryloyl machine of gamma-acryloxypropyl and gamma-meta-acryloxypropyl, Water acid radicals, such as gamma-hydroxypropyl, 2, and 3-dihydroxy propyloxy propyl, ** sulfhydryl groups, such as ** vinyl groups, such as a vinyl and propenyl, and gamma-mercapto propyl, ** amino groups, such as gamma-aminopropyl and N-beta (aminoethyl)-gamma-aminopropyl, ** halogen machines, such as gamma-chloropropyl, 1 and 1, 1-truffe ROORO propyl, a nona fluoro hexyl, and perfluoro octyl ethyl, other nitroglycerine, and a cyano substitution alkyl group can be mentioned. Alkyl groups, such as a methyl, ethyl, a propyl, and butyl, are especially desirable. Moreover, as a adding-water resolvability machine of X, a methoxy, the alkoxy group of ethoxy **, a halogen machine, and an acyloxy machine are mentioned. A six or less-carbon number alkoxy group is especially desirable.

[0045] The hardenability resin layer of this invention has the large effect of the compound further shown by the aforementioned general formula (1) being incorporated in a resin layer by the condensation reaction with the aforementioned organic silicon compound or this condensate, giving charge transportability to this siloxane system resin layer by reforming in the siloxane system resin layer containing the structural unit which has charge transportability, and reducing the value of ionization potential.

[0046]

General formula (1) B of a B-(R1-ZH) m general formula (1) is a basis more than univalent [including charge transportability compound structure]. The compound of BH which the compound structure excluding the machine (R1-ZH) in a general formula (1) as B includes charge transportability compound structure here has charge transportability ability, or replaced the machine (R1-ZH) in the aforementioned general formula (1) by the hydrogen atom means having charge transportability ability.

[0047] In addition, a definition can be given as a compound with which the detection current which the aforementioned charge transportability compound is a compound in which the property to have the drift mobility of an electron or an electron hole is shown, and originates in charge transportation by the well-known method of detecting charge transportability ability, such as the Time-Of-Flight method, as another definition is acquired.

[0048] Into the siloxane system resin layer containing the structural unit which has the aforementioned charge transportability ability, you may form the structure where the colloidal silica metallurgy group oxide particle was distributed in this siloxane system resin layer. That is, the hardenability resin layer of this invention is a resin layer composite-ized by this siloxane system resin and the colloidal silica metallurgy group oxide particle. A metallic-oxide particle is explained in full detail.

[0049] <Metallic-oxide particle> 1 micrometer of metallic-oxide particles of this invention is a 10 to

200nm metallic-oxide particle especially preferably in 1nm of mean particle diameters, and it is usually compounded by the liquid phase process.

[0050] As an example of the metal atom of the aforementioned metallic-oxide particle, Si, Ti, aluminum, Cr, Zr, Sn, Fe, Mg, Mn, nickel, Cu, etc. are mentioned. These metallic-oxide particles can be obtained as a colloidal particle.

[0051] The colloidal particle of the aforementioned metallic-oxide particle is compoundable from metal oxides, such as a metal alkoxide or a metal aryl oxide usually expressed with the following general formula.

[0052] $M(OR)_4$ (M expresses a metal atom and R expresses the alkyl group of carbon numbers 1-20, an aryl group, a phenyl group, and a benzyl.)

This colloidal particle passes a sol-gel process. In a sol-gel process, a sol is first obtained by suspending a metal oxide in the bottom alcohol of existence of a catalyst / aqueous solvent. The metal oxide in this solution is condensed in the gel structure in response to hydrolysis. Gel is condensed and forms the colloidal particle of the metallic-oxide particle which precipitated.

[0053] Moreover, as for the aforementioned colloidal silica metallurgy group oxide particle, it is desirable to have the aforementioned organic silicon compound and the compound machine which has reactivity on this particle front face. As a compound machine which has this reactivity, a hydroxyl group, the amino group, etc. are mentioned, for example. By using the colloidal silica metallurgy group oxide particle which has such a reactant machine, the resin layer to which this front face considered the chemical bond as the siloxane system resin is formed, the siloxane system resin layer of this invention turns into intensity and a resin layer which reinforced elasticity further, and if this resin layer is used as a protective layer of a photo conductor, it will form a film with the good electrophotography property which cannot be easily worn out to the scratch of blade cleaning etc.

[0054] As a composition ratio in the constituent of a total amount (H) with the condensate formed from the organic silicon compound which has the organic silicon compound which has the aforementioned hydroxyl group or a adding-water resolvability machine and a hydroxyl group, or a adding-water resolvability machine, and the compound (I) of the aforementioned general formula (1), in a mass ratio, it is desirable that it is 100:3-50:100, and it is between 100:10-50:100 more preferably.

[0055] Moreover, as for the addition of a colloidal silica metallurgy group oxide particle (J), it is desirable to use 1 - 30 mass section for (J) to the gross-mass 100 section of an aforementioned (total amount H) + compound (I) component.

[0056] If the aforementioned total amount (H) component is used within the limits of the above, as a protective layer of the photo conductor of this invention, a degree of hardness is high and elasticity can form a hardenability resin layer. (J) The inclination as the aforementioned total amount (H) component for the excess and deficiency of the metallic-oxide particle of a component to be also the same is seen. On the other hand, if the aforementioned compound (I) component is used within the limits of the above, the difference of the ionization potential between the aforementioned siloxane system resin and a photosensitive layer is reduced, and electrophotography properties, such as sensitivity and a rest-potential property, are good, and can obtain a photo conductor with high surface hardness.

[0057] In order to promote a condensation reaction to form the aforementioned siloxane system resin layer, it is desirable to use a condensation catalyst. Although the condensation catalyst used here carries out the catalyst which acts on a condensation reaction in contact, and the work which moves the reaction balance of a condensation reaction to a product, it should just have one of operations at least.

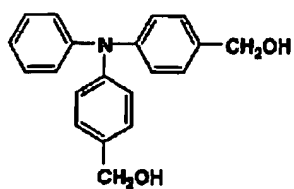
[0058] The well-known catalyst used for silicon hard-coat material conventionally [, such as an acid, a metallic oxide, a metal salt, and an alkylamino silane compound,] as a concrete condensation catalyst can be used. For example, each alkali-metal salt of an organic carboxylic acid, a nitrous acid, a sulfurous acid, an ulmin acid, carbonic acid, and a thiocyanic acid, an organic amine salt (hydroxylation tetramethylammonium, tetramethylammonium acetate), tin organic acid chloride (SUTANNASU octoate, a Djibouti rutin diacetate, dibutyltin dilaurate, a Djibouti rutin mercaptide, Djibouti rutin thiocarboxylate, dibutyl CHIMMARIETO, etc.), etc. are mentioned.

[0059] The example of representation of a general formula (1) is shown below.

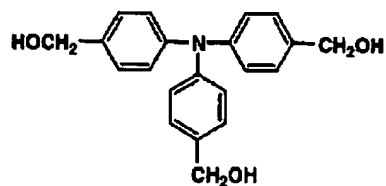
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[Formula 2]

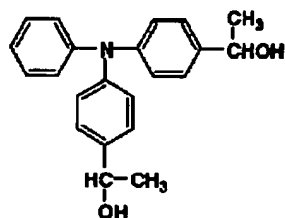
(B-1)



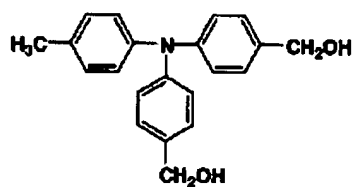
(B-2)



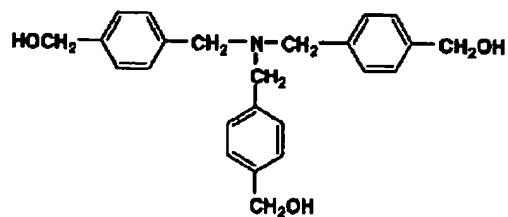
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(B-4)



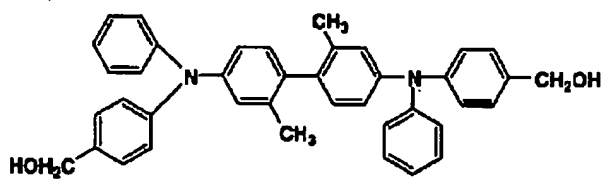
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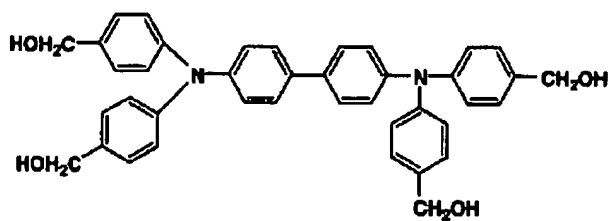
[0061]

[Formula 3]

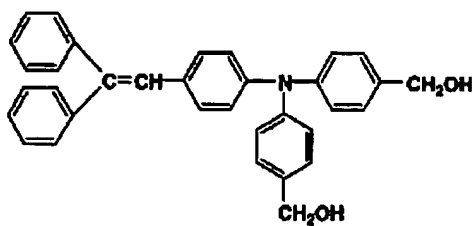
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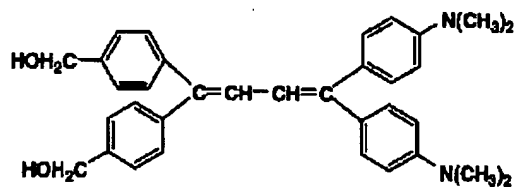
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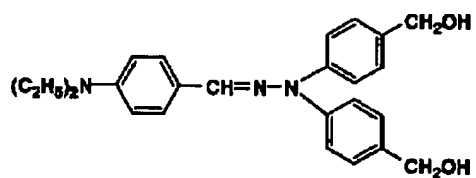
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(B-9)



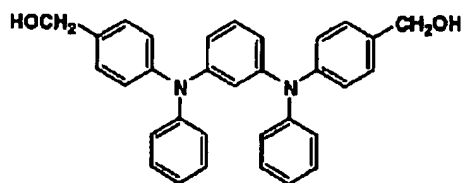
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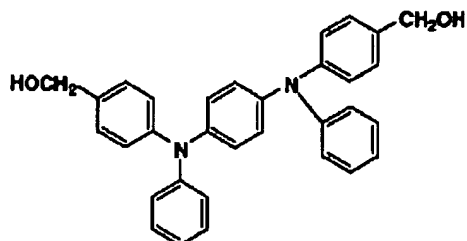
[0062]

[Formula 4]

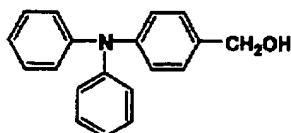
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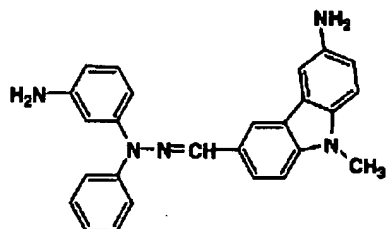
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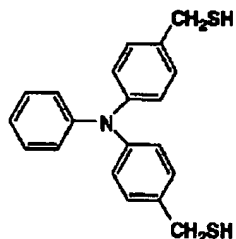
(B-13)



(B-14)



(B-15)



[0063] Furthermore, even if it uses the compound of the following general formula (4), the siloxane system resin layer containing the structural unit which has charge transportability ability can be formed.

[0064] General formula (4)

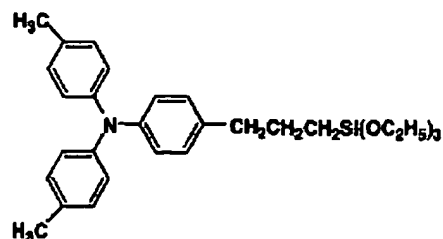
B is a basis containing the structural unit which has charge transportability ability among a B-(-R1-Si(R11)3-a(R12) a) n formula, R11 shows the alkyl group which is not replaced [a hydrogen atom, substitution, or] and an aryl group, R12 shows a adding-water resolvability machine or a hydroxyl group, and R1 shows the alkylene machine which is not replaced [substitution or]. a shows the integer of 1-3 and n shows an integer.

[0065] The example of representation of the aforementioned general formula (4) is shown below.

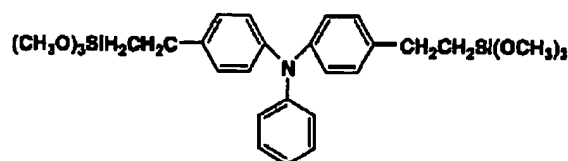
[0066]

[Formula 5]

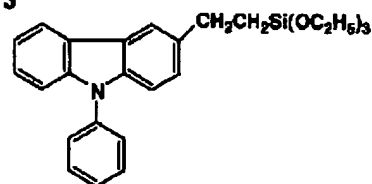
Si-1



Si-2



Si-3



[0067] Among the compounds shown by the aforementioned general formula (1), Z is a hydroxyl group (OH) and m of the most desirable compound is two or more compounds. Z is a hydroxyl group (OH), and m can reduce the ionization potential value of a hardenability resin layer by this compound's reacting with the aforementioned organic silicon compound, and entering into the network structure of a siloxane system resin, and two or more compounds can give sufficient charge transportability ability for this hardenability resin layer.

[0068] The charge transportability compound shown by the aforementioned general formula (1) is the resin structure incorporated by the chemical reaction into the siloxane system resin, and the above resin structures are incorporated by the substructure shown by the aforementioned general formula (2) into this siloxane system resin structure. That is, it combines with the connection atom or connection machine (Y) shown by Y in the aforementioned general formula (2) through the carbon atom or silicon atom which constitutes this charge transportability compound, and contains in a siloxane system resin through Y.

[0069] Y of the aforementioned general formula (2) is the atom or basis more than divalent [except the adjoining joint atom (the silicon atom Si and the carbon atom C which constitutes a part of structural unit which has the aforementioned charge transportability ability)] preferably.

[0070] However, when Y is an atom more than trivalent, the joint hand of Si in a formula and Y other than C has the structure (basis) which had combined with the composition atom of either of the combinable aforementioned siloxane system resins, or was connected with other atoms and the molecule machine.

[0071] Moreover, an oxygen atom (O), a sulfur atom (S), and a nitrogen atom (N) are especially desirable as a Y atom in the aforementioned general formula.

[0072] Here, when Y is a nitrogen atom (N), the aforementioned connection machine is expressed with -NR- (R is a hydrogen atom or a monovalent organic machine).

[0073] Although the structural unit X which has charge transportability ability is shown as a monovalent basis in the formula, when the siloxane system resin and the charge transportability compound made to

react have two or more reactant functional groups, in a siloxane system resin, you could join as a crosslink machine more than divalent, and it may only be joined as a pendant machine.

[0074] The ionization potential value of this siloxane system resin layer changes also with the chemical structure and its amount of the structural unit X which has the aforementioned charge transportability ability in which the aforementioned siloxane system resin layer is contained as a substructure of this resin structure. Since the difference of ionization potential with the photosensitive layer which, as a result, adjoins this siloxane system resin layer is expanded exceeding the range of this invention, such a photo conductor causes degradation of the fall of sensitivity, the rise of a rest potential, and the time-response nature of an electrophotography property.

[0075] As the manufacture method of this siloxane system resin layer of reducing most effectively the ionization potential of the aforementioned siloxane system resin layer, and bringing it close to the ionization potential of a photosensitive layer, Z is a hydroxyl group (OH) in the compound of a general formula (1), and m is two or more compounds. Z is a hydroxyl group (OH) and, as for two or more compounds, this compound reacts [m] with the aforementioned organic silicon compound. The ionization potential value of a hardenability resin layer is reduced by entering into the network structure of a siloxane system resin. This ionization potential value approaches the ionization potential value of the photosensitive layer which adjoins this hardenability resin layer, reduces the electric-field obstruction of the contact interface of a photosensitive layer and a siloxane system resin layer, and makes good sensitivity as the whole photo conductor, and time-response nature of a rest potential or an electrophotography property. On the other hand, it is required for Z to fully adjust each constituent which constitutes this siloxane system resin layer in order to bring close to the ionization potential of the photosensitive layer which adjoins the ionization potential of this siloxane system resin layer, and its constituent ratio by the difference in the chemical structure of the charge transportation structure X, also in the compound of a hydroxyl group, since the ionization potential of a siloxane system resin layer changes a lot.

[0076] It is also effective to, bring the ionization potential of a photosensitive layer close to the ionization potential of a hardenability resin layer on the other hand as a method of making small the difference of the ionization potential of the photosensitive layer of this invention and a hardenability resin layer. The photosensitive-layer composition of this invention is indicated below.

[0077] Although there is especially no limitation, as for the lamination of the electrophotography photo conductor of this invention, it is desirable to take photosensitive layers, such as a charge generating layer, a charge transporting bed, or charge generating, a charge transporting bed, etc. (layer which has the function of charge generating and charge transportation in the same layer), and the composition which painted the hardenability resin layer of this invention on it.

[0078] Although the photosensitive-layer composition of the monolayer structure which gave the charge generating function and the charge transportation function to one layer on the aforementioned interlayer may be used for the photosensitive-layer composition of the photo conductor of a photosensitive-layer this invention, it is good to take the composition which divided the function of a photosensitive layer into the charge generating layer (CGL) and the charge transporting bed (CTL layer) more preferably. The increase in a rest potential accompanying use can be controlled small repeatedly, and it is easy to control by taking the composition which separated the function [for the purpose of other electrophotography properties]. It is desirable to take a charge generating layer (CGL) on an interlayer, and to take the composition of a charge transporting bed (CTL layer) on it in the photo conductor for negative electrification. In the photo conductor for right electrification, it becomes reverse, in case the order of the aforementioned lamination is a photo conductor for negative electrification. The most desirable photosensitive-layer composition of this invention is negative electrification photo conductor composition which has the aforementioned functional isolation construction.

[0079] The photosensitive-layer composition of a functional separation negative electrification photo conductor is explained below.

Charge generating layer charge generating layer: Contain the charge generating matter (CGM) in a charge generating layer. As other matter, you may contain a binder resin and other additives as occasion

demands.

[0080] The charge generating matter (CGM) well-known as charge generating matter (CGM) can be used. For example, a phthalocyanine pigment, an azo pigment, a perylene pigment, an AZURENIUMU pigment, etc. can be used. CGM of the phthalocyanine pigment which CGM which can make the smallest repeatedly the increase in a rest potential accompanying use in these has the solid and potential structure where stable condensation structure can be taken among two or more molecules, and specifically has the specific crystal structure, and a perylene pigment is mentioned. for example, degradation repeatedly accompanying use in CGM, such as titanylphthalocyanine to which Bragg angle 2θ to Cu-K alpha rays has the maximum peak at 27.2 degrees, and a benzimidazole perylene to which this 2θ has the maximum peak in 12.4, -- almost -- there is nothing -- the increase in a rest potential -- it can be made small

[0081] Although a resin well-known as a binder can be used when using a binder for a charge generating layer as a dispersion medium of CGM, as most desirable resin, a formal resin, a butyral resin, silicon resin, a silicon denaturation butyral resin, a phenoxy resin, etc. are mentioned. The rate of a binder resin and the charge generating matter has the desirable 20 - 600 mass section to the binder resin 100 mass section. By using these resins, the increase in a rest potential accompanying repeat use can be made the smallest. The thickness of a charge generating layer has 0.01 micrometers - desirable 2 micrometers.

[0082] Charge transporting-bed charge transporting bed: Contain the binder resin which distributes the charge transportation matter (coal tar mixture) and coal tar mixture, and produces a film in a charge transporting bed. As other matter, you may contain additives, such as an antioxidant, as occasion demands.

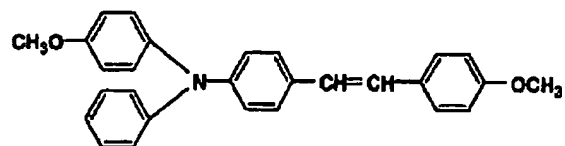
[0083] The charge transportation matter (coal tar mixture) well-known as charge transportation matter (coal tar mixture) can be used. For example, a triphenylamine derivative, a hydrazone compound, a styryl compound, a benzidine compound, a butadiene compound, etc. can be used. These charges transportation matter usually dissolves into a suitable binder resin, and layer formation is performed.

[0084] It depends for the ionization potential of a charge transporting bed on the structure and the amount of the charge transportability compound which is the main constituent of this charge transporting bed greatly. It is important for the useful compound of this invention in various kinds of above-mentioned charge transportation matter to choose a compound with which the difference is set to 0.4 (eV) in the ionization potential of this charge transporting bed smaller than the ionization potential of the aforementioned hardenability resin layer. The charge transportability matter useful to this invention has the desirable compound which has the value of ionization potential in 5.0-5.7 (eV), and is a compound which has the ionization potential of 5.2-5.5 (eV) more preferably. The following compounds are mentioned if it considers as such charge transportation matter.

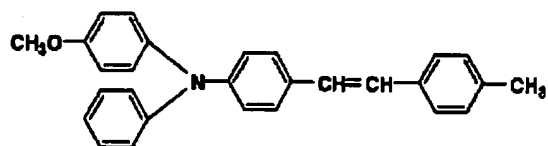
[0085]

[Formula 6]

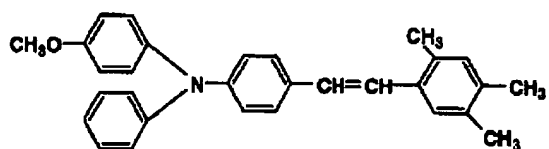
(T-1)



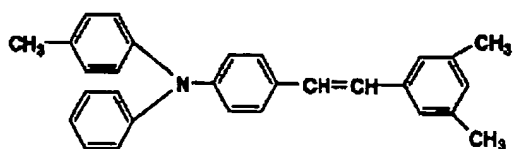
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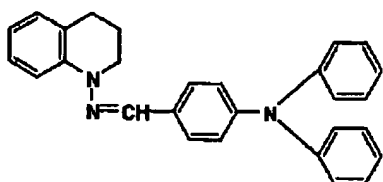
(T-3)



(T-4)



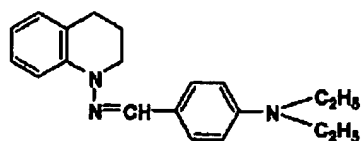
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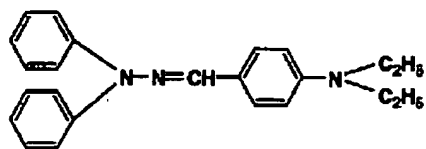
[0086]

[Formula 7]

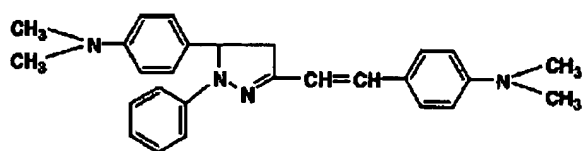
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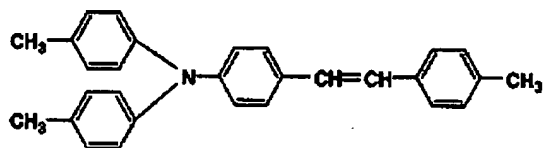
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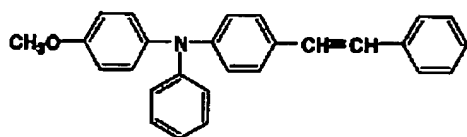
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(T-9)



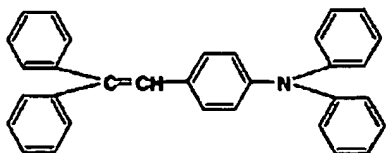
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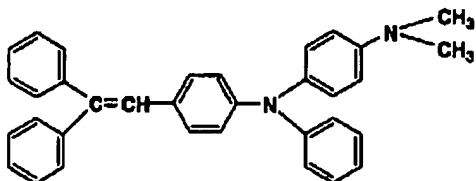
[0087]

[Formula 8]

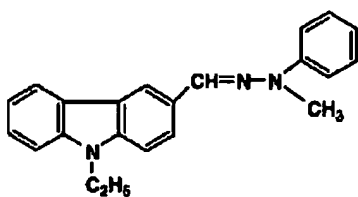
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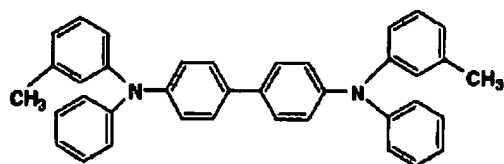
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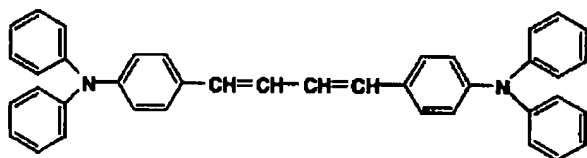
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(T-14)



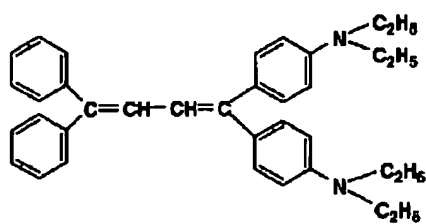
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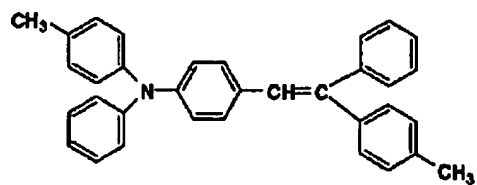
[0088]

[Formula 9]

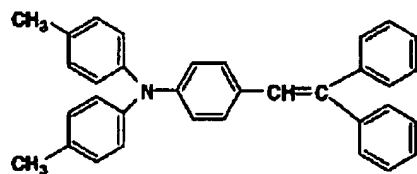
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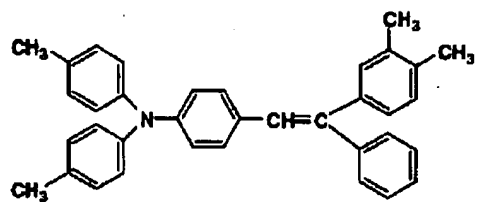
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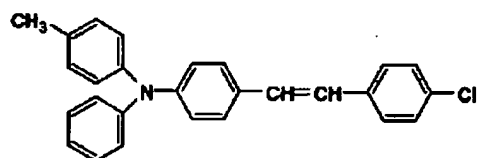
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(T-19)



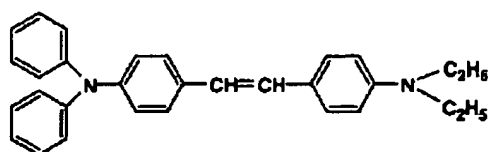
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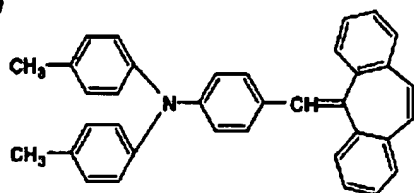
[0089]

[Formula 10]

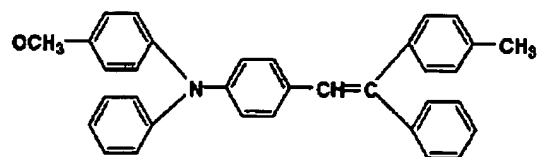
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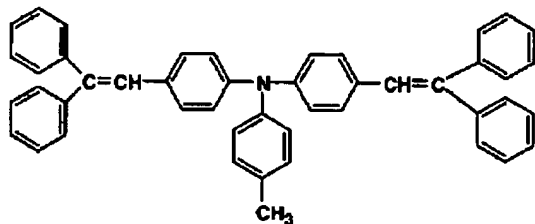
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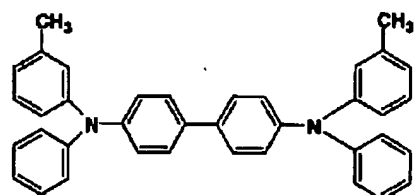
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(T-24)

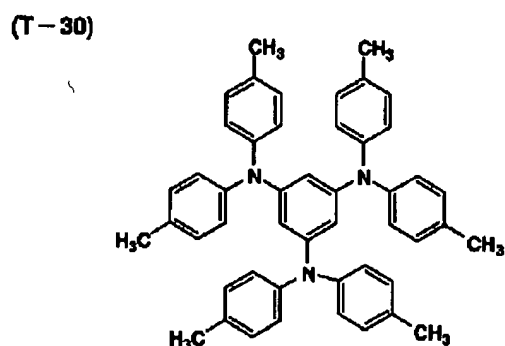
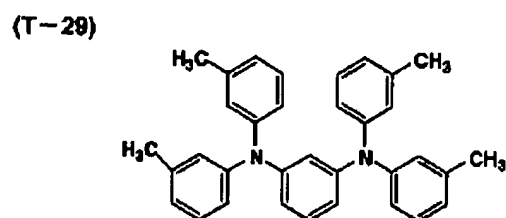
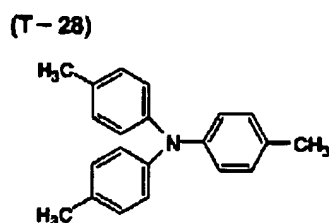
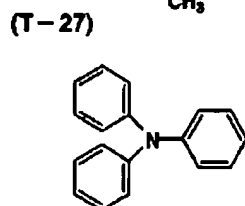
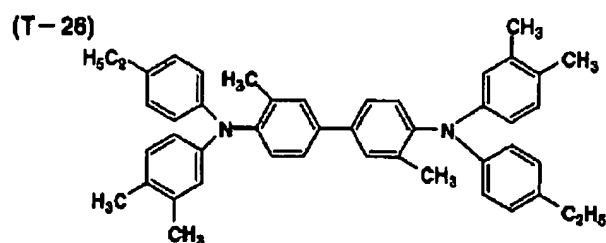


(T-25)



[0090]

[Formula 11]



[0091] By this invention, ionization potential is measured by surface analysis equipment AC-1 (Riken Keiki Co., Ltd. make).

[0092] As a resin used for a charge transporting bed (CTL layer), they are polystyrene, acrylic resin, methacrylic resin, vinyl chloride resin, a vinyl acetate resin, polyvinyl butyral resin, an epoxy resin, a polyurethane resin, phenol resin, polyester resin, an alkyd resin, polycarbonate resin, silicon resin, melamine resin, and the copolymer resin containing two or more of the repeat units of these resins, for example. Moreover, macromolecule organic semiconductors, such as Poly N-vinylcarbazole besides these insulating resins, are mentioned.

[0093] The most desirable thing as a binder of these CTL is polycarbonate resin. Polycarbonate resin is the most desirable in making good the dispersibility of coal tar mixture, and an electrophotography property. The rate of a binder resin and the charge transportation matter has the desirable 10 - 200 mass section to the binder resin 100 mass section. Moreover, the thickness of a charge transporting bed has desirable 10-40 micrometers.

[0094] Next, it is desirable to make the hardenability resin layer of this invention contain an antioxidant. This antioxidant is matter which has prevention or the property to suppress for an operation of oxygen under conditions, such as light, heat, and electric discharge, to the autoxidation nature matter with which the typical thing exists in the inside of an electrophotography photo conductor, or a photo conductor front face. The detailed following compound group is mentioned.

[0095] (1) radical -- a chain inhibitor, phenol system antioxidant hindered phenol system, and amine system antioxidant hindered amine system diaryl diamine system diarylamine system -- a - hydroquinone system antioxidant (2) peroxide decomposition agent and a sulfur system antioxidant (thioether)

- Phosphoric acid system antioxidant (phosphites)

Among the above-mentioned antioxidants, the radical chain inhibitor of (1) is good and a hindered phenol system or a hindered amine system antioxidant is especially desirable. Moreover, two or more sorts of things may be used together, for example, the combined use with the hindered phenol system antioxidant of (1) and the antioxidant of the thioether of (2) is also good. Furthermore, the above-mentioned structural unit, for example, a hindered phenol structural unit, and the hindered amine structural unit may be included in the molecule.

[0096] An effect is [a hindered phenol system and a hindered amine system antioxidant] especially in especially generating of fogging and picture dotage prevention at the time of high-humidity/temperature also in the aforementioned antioxidant.

[0097] The content in the resin layer of a hindered phenol system or a hindered amine system antioxidant has desirable 0.01 - 20 mass %. When it is under 0.01 mass %, there is no effect in fogging at the time of high-humidity/temperature, or picture dotage, from 20 mass %, in many contents, the fall of the charge transportation ability in a resin layer starts, it becomes easy to increase a rest potential, and the fall of **** intensity occurs.

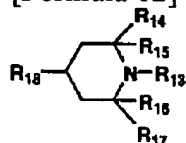
[0098] Moreover, you may make a lower layer charge generating layer or a charge transporting bed, an interlayer, etc. contain the aforementioned antioxidant as occasion demands. The addition of the aforementioned antioxidant to these layers has desirable 0.01 - 20 mass % to each class.

[0099] The compounds which has a branching alkyl group in an ortho position to the hydroxyl group of a phenolic compound, and the derivative of those are called hindered phenol here (however, conversion of the hydroxyl group may be carried out to ARUKOKISHI).

[0100] a hindered amine system -- near N atom -- bulk -- it is the compound which has an organic high machine bulk -- there is a letter alkyl group of branching as an organic high machine, for example, t-butyl is desirable For example, the compounds which have the organic machine shown with the following structure expression are desirable.

[0101]

[Formula 12]



[0102] In R13 in a formula, a hydrogen atom or a univalent organic machine, and R14, R15, R16 and R17 show an alkyl group, and R18 shows a hydrogen atom, a hydroxyl group, or a univalent organic machine.

[0103] As an antioxidant with a hindered phenol substructure, although a compound given in JP, 1-118137, A (P7-P14) is mentioned, for example, this invention is not limited to this.

[0104] As an antioxidant with a hindered amine substructure, although a compound given in JP, 1-118138, A (P7-P9) is also mentioned, for example, this invention is not limited to this.

[0105] As an organic phosphorous compound, it is the compound expressed with general formula RO-P(OR)-OR, for example. In addition, in here, R expresses a hydrogen atom, the alkyl group which has not been replaced [substitution or] respectively, an alkenyl machine, or an aryl group.

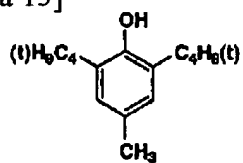
[0106] As an organic-sulfur system compound, it is typical with the compound expressed with general formula R-S-R, for example. In addition, in here, R expresses a hydrogen atom, the alkyl group which has not been replaced [substitution or] respectively, an alkenyl machine, or an aryl group.

[0107] The example of a compound of a typical antioxidant is given to below.

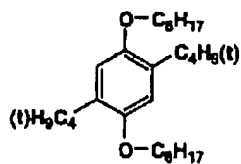
[0108]

[Formula 13]

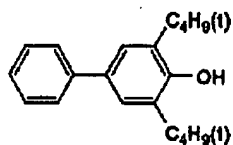
1-1



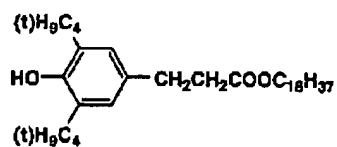
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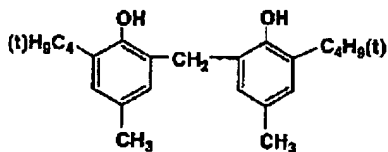
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1-4



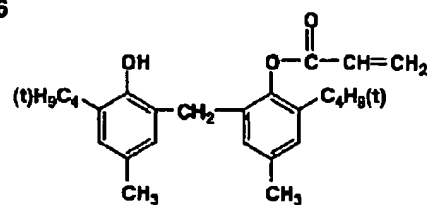
1-5



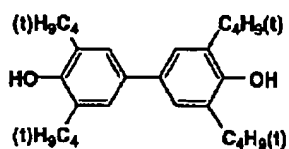
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[Formula 14]

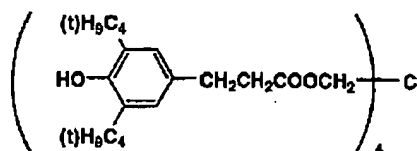
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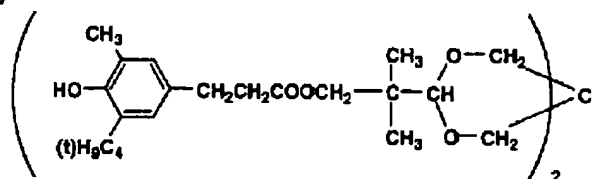
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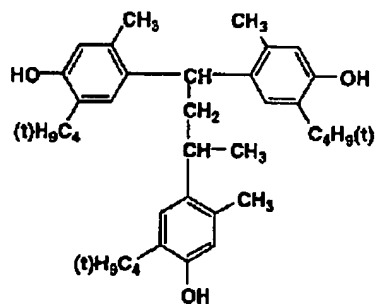
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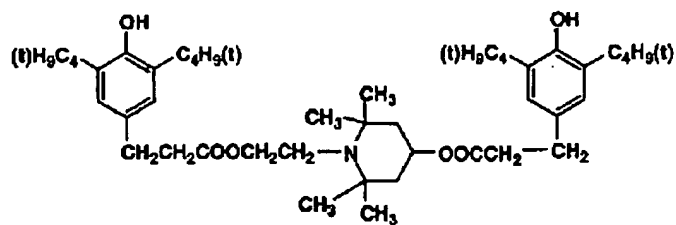
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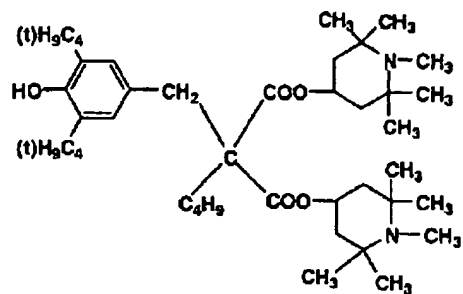
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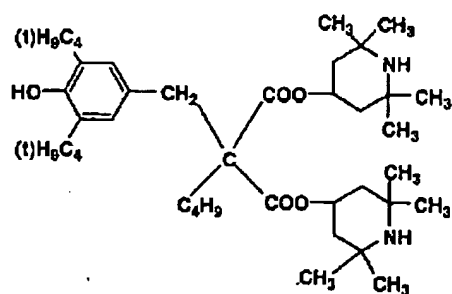
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2-2

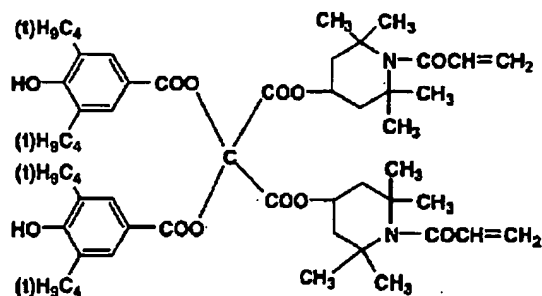


2-3

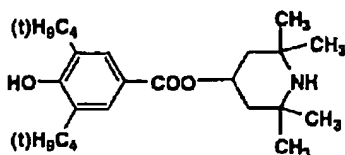


[0111]
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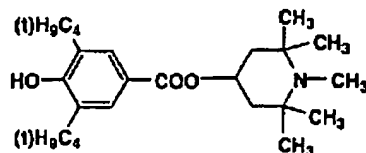
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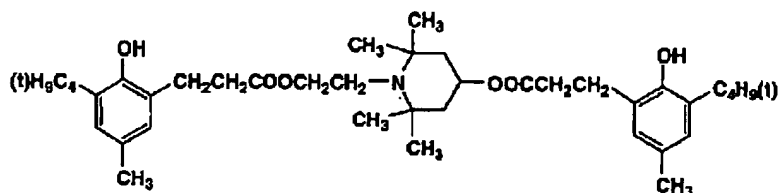
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2-7



[0112] Next, the composition of photo conductors other than the aforementioned hardenability resin layer and a photosensitive layer is indicated.

Although whichever of the shape of a sheet and a cylinder may be used as a conductive base material used for the photo conductor of a conductive base material this invention, in order to design image formation equipment compactly, the cylinder-like conductivity base material is more desirable.

[0113] The cylinder-like conductivity base material of this invention has the conductive desirable base material which means the base material of the shape of a cylinder required to be able to form a picture in endless, and is in 0.1mm or less and the range of 0.1mm or less of deflections by the straightness by rotating. If the range of this roundness and a deflection is exceeded, good image formation will become difficult.

[0114] The plastics drum which deposited metal drums, such as aluminum and nickel, or aluminum, a tin oxide, oxidation in JUUMU, etc. as a conductive material, or the paper and the plastics drum which applied the conductive matter can be used. As a conductive base material, 103ohms below of specific resistance cm are desirable in ordinary temperature.

[0115] That by which the alumite film by which sealing was carried out was formed in the front face may be used for the conductive base material used by this invention. Although alumite processing is usually performed, for example in acid baths, such as a chromic acid, a sulfuric acid, oxalic acid, a

phosphoric acid, a boric acid, and a sulfamic acid, a result with the most desirable anodizing in the inside of a sulfuric acid is given. Although it is [as for sulfuric-acid concentration] desirable that 100 - 200 g/l and aluminum ion concentration perform applied voltage by 1 - 10 g/l, and solution temperature performs it by about 20 V before and after 20 degrees C in the case of anodizing in the inside of a sulfuric acid, it is not limited to this. Moreover, especially the average thickness of anodized coating usually has desirable 10 micrometers or less 20 micrometers or less.

[0116] The interlayer who had the barrier function between the conductive base material and the photosensitive layer in the interlayer this invention can also be prepared.

[0117] In order to prevent an adhesive improvement with a conductive base material and the aforementioned photosensitive layer's, or charge pouring from this base material in this invention, an interlayer (an undercoating layer is also included) can also be prepared between this base material and the aforementioned photosensitive layer. As this interlayer's material, polyamide resin, vinyl chloride resin, a vinyl acetate resin, and the copolymer resin containing two or more of the repeat units of these resins are mentioned. As a resin which can make small repeatedly the increase in a rest potential accompanying use in these under-coating resin, polyamide resin is desirable. Moreover, the thickness of the interlayer using these resins has desirable 0.01-0.5 micrometers.

[0118] Moreover, the interlayer using the hardenability metal resin with which the interlayer most preferably used for this invention made organometallic compounds, such as a silane coupling agent and a titanium coupling agent, heat-harden is mentioned. The thickness of the interlayer using the hardenability metal resin has desirable 0.1-2 micrometers.

[0119] As the solvent used for formation of the interlayer of this invention, a photosensitive layer, and other resin layers, or a dispersion medium N butylamine, a diethylamine, ethylenediamine, an isopropanolamine, A triethanolamine, a triethylenediamine, N.N-dimethylformamide, An acetone, a methyl ethyl ketone, methyl isopropyl ketone, a cyclohexanone, Benzene, toluene, a xylene, chloroform, a dichloromethane, 1, 2-dichloroethane, 1, 2-dichloropropane, 1 and 1, 2-trichloroethane, 1 and 1, 1-trichloroethane, A trichloroethylene, a tetrachloroethane, a tetrahydrofuran, a dioxolane, a dioxane, a methanol, ethanol, a butanol, an isopropanol, ethyl acetate, butyl acetate, dimethyl sulfoxide, a methyl cellosolve, etc. are mentioned. Although this invention is not limited to these, a dichloromethane, 1, 2-dichloroethane, a methyl ethyl ketone, etc. are used preferably. Moreover, these solvents can also be used as independent or two or more sorts of mixed solvents.

[0120] Next, as the application processing method for manufacturing the electrophotography photo conductor of this invention, although the application processing methods, such as a dip painting cloth, a spray application, and a circular amount regulation type application, are used As for application processing by the side of the upper layer of a photosensitive layer, it is desirable to use the application processing methods, such as a spray application or a circular amount regulation type (for circular slide hopper type to be the example of representation) application, in order not to dissolve a lower layer film as much as possible, and in order to attain uniform application processing. In addition, it is indicated in detail by JP,3-90250,A and JP,3-269238,A, and the aforementioned spray application is indicated in detail about the aforementioned circular amount regulation type application at JP,58-189061,A.

[0121] Although the electrophotography photo conductor of this invention is adapted for general electrophotography equipment, such as an electrophotography copying machine, a LASER beam printer, an LED printer, and a liquid crystal shutter formula printer, it is broadly applicable also to equipments, such as the display and record adapting electrophotographic technology, implant printing, platemaking, and facsimile, further.

[0122] Next, an example is given and explained about the image formation method and image formation equipment which apply the electrophotography photo conductor of this invention.

[0123] - Electrification pre-exposure process (exposure for eliminating the charge which remains on a photo conductor by the last image formation) : as an electrification pre-exposure process, the optical irradiation by Light Emitting Diode etc. is used. An electrification pre-exposure can suppress generating of the memory resulting from the elevation and the exposure pattern of a rest potential by the delay of a response of a photo conductor. However, the electrophotography photo conductor of this invention can

acquire the picture which the system without an electrification pre-exposure also continued and was stabilized at the long period of time.

[0124] - Electrification process : both corona electrical charging and a contact electrification method can be used suitably. In order that direct live-part material may contact an electrophotography photo conductor, a photo conductor tends to receive a damage and, especially as for a contact electrification method, the effect of the photo conductor of this invention shows up notably. Although the electrification potential to a photo conductor top is suitably determined by the photo conductor to be used, it is charged at this electrification process so that it may be set to 300-1500V on electrification voltage.

[0125] - image exposure process: -- the exposure light source -- the white light, and Light Emitting Diode and LD -- although all can be used suitably, if light exposure becomes large too much -- a rest potential -- going up -- being easy -- the effect of the photo conductor of this invention shows up notably In the case of a digital image, the image exposure light source has Light Emitting Diode and desirable LD.

[0126] The photo conductor of this invention fits the digital image exposure method of pulse width modulation (PWM) used in order to form halftone high-definition in recent years.

[0127] Especially the color picture formation equipment especially for which this method performs halftone pixel formation by modulating time irradiating a laser beam, it can form the picture of high resolution and high gradation nature in according to this method, therefore needs high resolution and high gradation nature according to a picture signal is suitable. That is, according to this method, halftone can be expressed, without being able to perform the area gradation of the dot formed of the beam spot for every pixel, and reducing resolution.

[0128] However, also in this PWM, since a pixel would become small relatively to the diameter of an exposure spot if pixel density is raised further, there was a trouble that the gradation by the exposure-time modulation could not fully be taken. Especially the picture finally acquired since the conventional electrophotography photo conductor is not enough as the conditions of the latent image formed on a photo conductor and development in spite of having turned an optical spot area minutely had the problem that the advantage of this PMW method could not fully be reproduced. That is, when the phenomenon of falling by the space where the contrast of the potential potential produced by the phenomenon in which the image information given by the optical spot since diffusion was produced while the optical carrier for forming a latent image runs a photosensitive layer deteriorates, or the formed latent image exists by the conductive base material arises, and the image information given by the optical spot in early stages deteriorates greatly, it is thought that deterioration of quality of image has occurred.

[0129] Since it has the hardenability resin layer which has the structure of cross linkage including the structural unit to which the photo conductor of this invention has load transportability on a photosensitive layer to the above troubles, the sum total thickness of a photosensitive layer and a hardenability resin layer can be designed thinly, and latent-image formation can be carried out without degrading the given image information even if it turns the aforementioned optical spot area minutely, since the surface potential damping-time responsibility after optical irradiation is fully still quicker.

[0130] The photo conductor of this invention can fully demonstrate the feature of this photo conductor in the image formation method of performing spot area for image exposure with 2000-micrometer two or less beam, or image formation equipment. Even if this spot area uses two or less 1000-micrometer beam light, the image formation method and image formation equipment using the photo conductor of this invention can fully form the picture corresponding to this spot area. It enables especially the photo conductor that has the hardenability resin layer of this invention to reproduce more faithfully the latent-image formation to this beam light, even if spot area is two or less detailed 1000-micrometer beam light, since the time-response nature of the aforementioned this invention can fulfill the property for 0.25 or less seconds for the total thickness of the photosensitive layer of this photo conductor, and a hardenability resin layer enough also as 15 micrometers or less. The picture quality which excelled [dpi / 400 or more] in the place which realizes 256 gradation extremely as a result can be attained.

[0131] This beam luminous intensity is expressed in the area corresponding to the optical intensity beyond $1/e^2$ of peak intensity as the spot area of the aforementioned beam light.

[0132] There are solid-state scanners, such as scanning optical system used using semiconductor laser as a light beam, and Light Emitting Diode, a liquid crystal shutter, etc., and although there are Gaussian distribution, a Lorentz distribution, etc. also about optical intensity distribution, let the portion to 1 of each peak intensity / e^2 be spot area.

[0133] - Development process : at a development process, any developer of one component and two components is usable, and both magnetism and a nonmagnetic toner can be used suitably. Especially, in the high-speed image formation method that the process time from the aforementioned image exposure process to this development process is short, image formation equipment, or the image formation method and image formation equipment using the small cylinder-like photo conductor of a diameter, it is a high degree of hardness, and, as for the photo conductor of a good this invention, time-response nature can demonstrate the feature.

[0134] Namely, as for one of the image formation methods and image formation equipment using the photo conductor of this invention, time until development is started in the following development process after image exposure at an image exposure process on this photo conductor is characterized by the image formation method of 100 or less msec, and image formation equipment. Even if this image formation method and image formation equipment design the small copying machine and small printer which used the high-speed copying machine and printer of 40 or more sheets of A4 papers, and the cylinder-like photo conductor below the diameter ϕ of 30mm, they make it possible to produce a detailed picture faithfully.

[0135] - Imprint process : although all of an imprint method that use a corona transfer, a roller transfer, and a middle imprint object are suitably used for an imprint process, since adhesion with electrostatic paper powder becomes easy to take place, in a corona transfer, the effect of the photo conductor of this invention shows up notably.

[0136] - Partition stage : since separability is inferior in especially the electrophotography photo conductor formed in the cylinder-like base material of a major diameter, presser-foot-stitch-tongue separation is effective. However, by the presser-foot-stitch-tongue separation method, since an electrophotography photo conductor tends to be influenced of **** generated by contact of a separation presser foot stitch tongue, the electrophotography photo conductor of this invention shows a remarkable effect in the process of presser-foot-stitch-tongue separation.

[0137] - Cleaning process : usually, a cleaning blade is used suitably and can use a fur brush and a roller as an auxiliary member of cleaning further. Since cleaning conditions influence wear of a photo conductor greatly, they can be equivalent to a broad cleaning process by using the electrophotography photo conductor of this invention.

[0138] - Fixing process : heating fixing is desirable. For example, heating roller fixing, flash plate fixing, etc. are used.

[0139] The image formation method by which the photo conductor of this invention is applied is applied also to the process applied and developed on the basis of the image formation process described above.

[0140] For example, in color development, the photo conductor of this invention is applied also to the image formation method by which an electrification machine or a development counter is arranged around two or more photo conductors.

[0141] Moreover, at an imprint process, it is applied also to a process which uses a middle imprint object. At a cleaning process, the process which has the auxiliary mechanism and paper powder removal function of cleaning may be added.

[0142] Next, they are books, such as thickness wear of a photo conductor, and filming, especially in the above-mentioned image formation process.

[0143] - It is desirable to clean the toner which was not imprinted by the photo conductor using equipment equipped with the cleaning member of the shape of a blade by which pressure-welding arrangement was carried out in the property and contact condition this invention of a cleaning blade, but remained on the photo conductor. It contacts in the direction of a counter to the photo conductor of a

cleaning blade, and, as for these contact conditions, it is desirable to contact with the linear pressure of 5 - 50 g/cm from a viewpoint which raises cleaning nature. If a linear pressure is less than 5 g/cm, it will become easy to generate the grinding omission of a toner, and if larger than 50 g/cm, it will become easy to generate blade MEKURE.

[0144] In addition, in the preceding paragraph story of a cleaning process, in order to make cleaning easy, it is desirable to add the electric discharge process which discharges a photo conductor front face. This electric discharge process is performed by the electric discharge machine which produces for example, alternating current corona discharge.

[0145] 65 degrees - 75 degrees and impact resilience have [the degree of hardness of the cleaning blade used for this invention] 15% - 60% (under the condition of 20 degrees C and 50**5%RH) of desirable rubber elasticity object. if impact resilience is less than 15% -- bounding of a blade -- a cause -- being easy -- if reservation of the cleaning nature in low-temperature environment is difficult and exceeds 75%, the imitation nature of a blade will become large conversely and it will become easy to generate blade MEKURE (the physical-properties value; degree of hardness and impact resilience of the elastic body rubber blade used for the aforementioned cleaning blade are measured as a JISA degree of hardness and impact resilience based on the vulcanized-rubber physical-test method of JISK6301)

[0146] Although silicone rubber, polyurethane rubber, etc. are used, as for the cleaning blade used for this invention, what was made from polyurethane rubber is the most desirable.

[0147] Next, the toner and developer which are used for this invention are explained.

Toner>> used for <<this invention

<Shape factor of a toner> The "shape factor" of the toner used for this invention is shown by the following formula, and shows the degree of the roundness of a toner particle.

[0148]

shape factor = -- [(an overall diameter/2) 2π] / projected area -- an overall diameter means the width of face of the particle from which the interval of the parallel lines serves as the maximum in the projection image to the flat-surface top of a toner particle when it is a style in two parallel lines here Moreover, projected area means the area of the projection image to the flat-surface top of a toner particle.

[0149] In this invention, this shape factor took the photograph which expanded the toner particle by 2000 times with the scanning electron microscope, and measured it by subsequently analyzing a photograph using "SCANNING IMAGE ANALYZER" (JEOL Co., Ltd. make) based on this photograph. Under the present circumstances, the shape factor of this invention is measured by the above-mentioned calculation formula using 100 toner particles.

[0150] In the toner used for this invention, it is desirable to make into several 65% or more the rate of the toner particle which has this shape factor in the range of 1.0-1.6, and it is several 70% or more more preferably. It is making into several 65% or more still more preferably the rate of the toner particle which has this shape factor in the range of 1.2-1.6, and is several 70% or more more preferably.

[0151] If the toner with which this shape factor was equal to the toner used for the image formation equipment of an effect this invention to this invention of a toner shape factor is used, the good picture which the electrification property of toner each becomes uniform and does not have fogging is producible. Moreover, if the rate of the toner particle which has a shape factor in the range of 1.0-1.6 uses 65-piece the toner it is [toner] several % or more, a toner particle will become is hard to be crushed, generating of a particle toner will decrease, and toner filming of the photo conductor by poor cleaning will be prevented.

[0152] Especially the method of controlling this shape factor is not limited. For example, the toner particle which made the shape factor 1.0-1.6, or 1.2-1.6 is prepared by the method of spraying a toner particle into a heat style, the method of repeating and giving the mechanical energy according a toner particle to impulse force into a gaseous phase, the method of adding in the solvent which does not dissolve a toner and giving a revolution style, etc., and there is a method of adding and adjusting this so that it may become within the limits of this invention into the usual toner. Moreover, the whole configuration is controlled by the stage of preparing the so-called polymerization method toner, and there is a method of adding and adjusting similarly the toner particle which adjusted the shape factor to

1.0-1.6, or 1.2-1.6 to the usual toner.

[0153] It is desirable at the point of excelling in surface homogeneity in the above-mentioned method as compared with the point that a polymerization method toner is simple as the manufacture method, and a pulverization toner etc.

[0154] <Coefficient of variation of the shape factor of a toner> "The coefficient of variation of a shape factor" of the toner used for this invention is computed from the following formula.

[0155] $[S1/K] \times 100$ of the shape factor of a toner (%) [coefficient-of-variation =]

S1 shows the standard deviation of the shape factor of 100 toner particles among [formula, and K shows the average of a shape factor.]

When the coefficient of variation of this shape factor uses 16% or less of toner, the effect described by the effect of the aforementioned shape factor is more notably discovered by the image formation equipment of this invention. Furthermore, the coefficient of variation of a desirable shape factor is 14% or less.

[0156] You may decide proper process end time, setting the resin particle (polymer particle) which constitutes the toner of this invention in order to control uniformly [there is very no variation in a lot and] the shape factor of this toner, and the coefficient of variation of a shape factor to manufacture (polymerization), setting the resin particle concerned at weld and the process which carries out configuration control, and carrying out the monitoring of the property of the toner particle (coloring particle) formed.

[0157] It is the meaning of including a measuring device in in-line as carrying out monitoring, and controlling process conditions based on the measurement result. That is, in the polymerization method toner formed by including measurement of a configuration etc. in in-line, for example, making a resin particle meet or weld in a drainage system medium, when a configuration and particle size are measured and it becomes a desired configuration, sampling serially at processes, such as weld, a reaction is stopped.

[0158] Especially as the monitoring method, although not limited, flow formula particle image analysis apparatus FPIA-2000 (TOA Medical Electronics Co., Ltd. make) can be used. Since it can carry out the monitoring of the configuration by performing an image processing on real time, this equipment passing a sample solution, it is suitable. That is, a reaction is stopped, when use a pump etc., it always acts as a monitor, it performs measuring a configuration etc. and it becomes a desired configuration etc. from a reaction place.

[0159] <Number coefficient of variation of a toner> The number particle size distribution and number coefficient of variation of a toner which are used for this invention are measured by Coulter-counter TA- or the coal tar multi-sizer (coal tar company make). It was used having connected the interface (product made from the department machine of a day) and personal computer which output particle size distribution using a coal tar multi-sizer in this invention. Particle size distribution and the mean particle diameter were computed by having measured the volume of a toner 2 micrometers or more, and the number, using a 100-micrometer thing as an aperture used in the aforementioned coal tar multi-sizer. Number particle size distribution express the relative frequency of a toner particle to a particle diameter, and a number mean particle diameter expresses the median size in number particle size distribution. "The number coefficient of variation in number particle size distribution" (henceforth the number coefficient of variation of a toner) of a toner is computed from the following formula.

[0160]

$[S2/Dn] \times 100$ of a toner (%) [number coefficient-of-variation =]

S2 shows the standard deviation in number particle size distribution among [formula, and Dn shows a number mean particle diameter (micrometer).]

The number coefficient of variation of the toner used for the effect this invention to this invention of the number coefficient of variation of a toner is 27% or less, and is 25% or less preferably. When number coefficient of variation is 27% or less, the amount distribution of electrifications becomes sharp, imprint efficiency becomes high, and quality of image improves. Whenever it uses such a toner for the image formation equipment of this invention, it is hard to generate the poor cleaning by which the

electrification property of a toner is stabilized, and the front face of the photo conductor which has the siloxane system resin layer of this invention can be kept clean.

[0161] Especially the method of controlling the number coefficient of variation in the toner used for this invention is not limited. For example, although the method of classifying a toner particle with a wind force can also be used, in order to make number coefficient of variation smaller, the classification in the inside of liquid is effective. There is a method of collecting by type and preparing a toner particle according to the settling-velocity difference which controls a rotational frequency and is produced by the difference in a toner particle diameter using a centrifugal separator as a method of classifying in this liquid.

[0162] When manufacturing a toner especially by the suspension-polymerization method, classification operation is indispensable in order to make number coefficient of variation in number particle size distribution into 27% or less. By the suspension-polymerization method, it is required before a polymerization to distribute the oil droplet of the size of the request of a polymerization nature monomer as a toner in a drainage system medium. That is, although mechanical shearing by the homomixer, the homogenizer, etc. will be repeated and an oil droplet will be made small to the size about a toner particle to the big oil droplet of a polymerization nature monomer, by the method by such mechanical shearing, the number particle size distribution of the oil droplet obtained will become large, therefore the particle size distribution of the toner which comes to carry out the polymerization of this will also become large. For this reason, classification operation becomes indispensable.

[0163] <Particle size of a toner particle> The particle size of the toner used for this invention has a 3-8-micrometer desirable thing at a number mean particle diameter. This particle size can be further controlled by composition of the polymer itself the concentration of a flocculant, the addition of an organic solvent, or weld time in the manufacture method of the toner explained in full detail behind, when making a toner particle form by the polymerization method.

[0164] When a number mean particle diameter is 3-8 micrometers, the large toner particle of the adhesion force which it adheres [adhesion force] to a photo conductor and generates FII rooming decreases, and imprint efficiency becomes high, the quality of image of a halftone improves, and quality of image, such as a thin line and a dot, improves.

[0165] When setting particle size of a toner particle to D (micrometer) as a toner used for this invention, In the histogram which shows the particle size distribution of the number criteria which divided this horizontal axis into two or more classes at 0.23 intervals for the natural logarithm $\ln D$ for the horizontal axis It is desirable that it is the toner whose sum (M) of the relative frequency (m1) of the toner particle contained in the maximum ***** and the relative frequency (m2) of the toner particle contained in the degree of the aforementioned maximum ***** at class with high frequency is 70% or more.

[0166] Since distribution of the particle size distribution of a toner particle becomes narrow when the sum (M) of a relative frequency (m1) and a relative frequency (m2) is 70% or more, generating of selection development can be certainly suppressed by using the toner concerned for an image formation process.

[0167] In this invention, the histogram which shows the particle size distribution of the aforementioned number criteria A natural logarithm $\ln D$ (D : particle size of each toner particle) Two or more classes at 0.23 intervals () [0-0.23: 0.23-0.46: 0.46-0.69: 0.69-0.92: 0.92-1.15: 1.15-1.38: 1.38-1.61: 1.61-1.84: 1.84-2.07: 2.07-2.30: 2.30-2.53: 2.53-2.76 -- the particle size distribution of the number criteria divided into ... It is the shown histogram. this histogram According to the following conditions, the particle-size data of the sample measured by the coal tar multi-sizer are transmitted to a computer through an I/O unit, and it is created by the particle-size-distribution analysis program in the computer concerned.

[0168] [Measurement conditions]

(1) aperture: -- 100-micrometer (2) sample method-of-preparation: -- electrolytic-solution [ISOTON R-11 (made in coal tar scientific Japan)] 50-100ml -- a surfactant (neutral detergent) -- a proper quantity -- in addition, stir and add 10-20mg of measurement samples to this It prepares by carrying out distributed processing of this system for 1 minute in an ultrasonic disperser.

[0169] In the case of the grinding method toner, the rate of the toner particle whose shape factors are

1.2-1.6 is about several 60%. The coefficient of variation of the shape factor of this thing is about 20%. Moreover, when the classification operation after pulverization is 1 time, the number coefficient of variation in number particle size distribution is about 30%, and in order to make number coefficient of variation into 27% or less, it needs to repeat classification operation further.

[0170] Since a polymerization is conventionally carried out into a laminar flow in the case of the toner by the suspension-polymerization method, in the toner which the toner particle of a true spherical was obtained mostly, for example, was indicated by JP,56-130762,A, the rate of the toner particle whose shape factors are 1.2-1.6 becomes about several 20%, and the coefficient of variation of a shape factor also becomes about 18%. Moreover, as described above as a method of controlling the number coefficient of variation in number particle size distribution, in order to repeat mechanical shearing and to make an oil droplet small to the size about a toner particle to the big oil droplet of a polymerization nature monomer, The particle size distribution of the toner which the distribution of the diameter of an oil droplet becomes large, therefore is obtained are large, and number coefficient of variation is as large as about 32%, and in order to make number coefficient of variation small, it needs classification operation.

[0171] In the polymerization method toner which forms a resin particle by making it meet or weld, in the toner indicated by JP,63-186253,A, for example, the rate of the toner particle whose shape factors are 1.2-1.6 is about several 60%, and the coefficient of variation of a shape factor is about 18%. Furthermore, the particle size distribution of a toner are large, and it is 30%, and number coefficient of variation needs classification operation, in order to make number coefficient of variation small.

[0172] The particle size of the toner used for this invention has desirable 3-8 micrometers at a volume mean particle diameter. The volume mean particle diameter and particle size distribution of a toner can be measured using Coulter-counter TA-II, a coal tar multi-sizer, SLAD1100 (laser diffraction formula particle-size measuring device by Shimadzu Corp.), etc. In Coulter-counter TA-II and a coal tar multi-sizer, it measures and asks for the particle size distribution in the range of 2.0-40 micrometers using a diameter = of aperture 100 micrometer aperture.

[0173] Furthermore, as for the aforementioned toner, it is desirable that the particle of less than 3.0 micrometers of volume mean particle diameters of a toner is several 30% or less. There is nothing what is limited especially as a method of manufacturing this toner. It is possible to grind suppressing overgrinding also by the pulverization classifying method at the time of pulverization. Furthermore, you may adopt the method of classifying repeatedly. The manufacture method of the toner by the suspension-polymerization method or the welding method of the so-called manufacture method of a polymerization method toner is also still more desirable.

[0174] in addition, a polymerization method -- if -- boil the particle removal by the centrifugal separation in the inside of the dispersion liquid of a resin particle etc. if needed -- ** can also be attained

[0175] make it any -- the grinding method toner -- be -- a polymerization method toner -- be -- if the requirements for the above-mentioned this invention are satisfied, the purpose of this invention can be attained

[0176] The <manufacture method of the toner used for this invention> The grinding method most generally used, i.e., a binder resin and a coloring agent, and the other various additives added by the need may be classified after kneading pulverization, and the manufacture method of the toner used for this invention may produce them, in a medium, may carry out synthetic production and may manufacture the resin particle containing the release agent and the coloring agent.

[0177] As a method of making it weld in a drainage system medium, the method indicated by JP,63-186253,A, a 63-282749 official report, JP,7-146583,A, etc. and a resin particle can be raised for a salting-out / the method of making weld and forming.

[0178] The resin particle used here has a desirable weighted-mean particle size of 50-2000nm, and it is an emulsion-polymerization method that they are preferably used by any granulation polymerization methods, such as an emulsion polymerization, a suspension polymerization, and a seed polymerization, although these resin particles are good.

[0179] Also in which manufacture method, a well-known polymerization nature monomer can be conventionally used for the monomer used for manufacture of the binder resin of the aforementioned grinding method, or the resin of the aforementioned resin particle. Moreover, it can use combining one sort or two sorts or more of things so that the property demanded may be fulfilled.

[0180] As a monomer which constitutes a styrene resin, an acrylic resin, and styrene-acrylic resin Styrene, o-methyl styrene, m-methyl styrene, p-methyl styrene, An alpha methyl styrene, p-chloro styrene, 3, 4-dichloro styrene, p-phenyl styrene, p-ethyl styrene, 2, 4-dimethyl styrene, p-t-butyl styrene, p-n-hexyl styrene, p-n-octyl styrene, The styrene or the styrene derivative like p-n-nonyl styrene, p-n-desyl styrene, and p-n-dodecyl styrene, A methyl methacrylate, an ethyl methacrylate, methacrylic-acid n-butyl, A methacrylic-acid isopropyl, a methacrylic-acid isobutyl, methacrylic-acid t-butyl, A methacrylic-acid n-octyl, methacrylic-acid 2-ethylhexyl, stearyl methacrylate, Methacrylic-acid lauryl, a methacrylic-acid phenyl, a methacrylic-acid diethylaminoethyl, Methacrylic-ester derivatives, such as dimethylaminoethyl methacrylate, A methyl acrylate, an ethyl acrylate, an acrylic-acid isopropyl, acrylic-acid n-butyl, Acrylic-acid t-butyl, isobutyl acrylate, an acrylic-acid n-octyl, Acrylic-acid 2-ethylhexyl, acrylic-acid stearyl, acrylic-acid lauryl, acrylic-ester derivatives, such as an acrylic-acid phenyl, acrylic-acid dimethylaminoethyl, and an acrylic-acid diethylaminoethyl, etc. are mentioned concretely, and these are independent -- or it can be combined and used

[0181] As a concrete instantiation compound of other vinyl system polymers Olefins, such as ethylene, a propylene, and an isobutylene, a vinyl chloride, Halogen system vinyls, such as a vinylidene chloride, vinyl bromide, a vinyl fluoride, and a fluoridation vinylidene Vinyl esters, such as a propionic-acid vinyl, vinyl acetate, and a BENZOE acid vinyl Vinyl ether, such as a vinyl methyl ether and vinyl ethyl ether Vinyl ketones, such as a vinyl methyl ketone, a vinyl ethyl ketone, and a vinyl hexyl ketone N-vinyl compounds, such as N-vinylcarbazole, N-vinyl indole, and N vinylpyrrolidone, Vinyl compounds, such as vinyl naphthalene and a vinylpyridine, acrylonitrile, There are an acrylic acid or methacrylic-acid derivatives, such as methacrylonitrile, acrylamide, N-butyl acrylamide, N, and N-dibutyl acrylamide, methacrylamide, N-butyl methacrylamide, and N-octadecyl acrylamide. these vinyls system monomer is independent -- or it can be combined and used

[0182] Furthermore, as an example of a monomer for obtaining a ** carboxylic-acid polymer by the styrene-acrylic resin (vinyl system resin), an acrylic acid, a methacrylic acid, alpha-ethyl acrylic acid, a fumaric acid, a maleic acid, an itaconic acid, a cinnamic acid, maleic-acid monobutyl ester, maleic-acid monochrome octyl ester, a cinnamic-acid anhydride, alkenyl succinic-acid methyl half ester, etc. are mentioned.

[0183] Furthermore, you may add cross linking agents, such as a divinylbenzene, ethylene glucol diacrylate, diethylene glycol diacrylate, triethylene glycol diacrylate, ethylene glycol dimethacrylate, diethylene-glycol dimethacrylate, and triethylene-glycol dimethacrylate.

[0184] Moreover, it is the resin which is made to carry out the condensation polymerization of the alcoholic component more than divalent to the carboxylic acid more than divalent, and is obtained as polyester resin. As an example of a divalent carboxylic acid, a maleic acid, boletic acid, a SHITORAKO acid, an itaconic acid, a guru octopus acid, a phthalic acid, an isophthalic acid, a terephthalic acid, a succinic acid, an adipic acid, a sebacic acid, an azelaic acid, a malonic acid, n-dodecyl succinic acid, an n-dodecenyl succinic acid, an iso dodecyl succinic acid, an iso dodecenyl succinic acid, n-octyl succinic acid, n-OKUTE nil succinic acid, etc. are mentioned, and these acid anhydrides can also be used.

[0185] moreover, as an example of the alcoholic divalent component which constitutes polyester resin Polyoxypropylene (2.2) -2, 2-screw (4-hydroxyphenyl) propane, Polyoxypropylene (3.3) -2, 2-screw (4-hydroxyphenyl) propane, A polyoxyethylene (2.0) -2, 2-screw (4-hydroxyphenyl) propane, The polyoxypropylene (2.0)-polyoxyethylene (2.0) -2, 2-screw (4-hydroxyphenyl) propane, Polyoxypropylene (6) Etherification bisphenols, such as -2 and 2-screw (4-hydroxyphenyl) propane, Ethylene glycol, a diethylene glycol, a triethylene glycol, 1, 2-propylene glycol, 1, 3-propylene glycol, 1, 4-butanediol, 1, 4, a butene diol, neopentyl glycol, 1, 5-pentane glycol, 1, 6-hexane glycol, 1, 4-cyclohexane dimethanol, A dipropylene glycol, a polyethylene glycol, a polypropylene glycol, a polytetramethylene glycol, bisphenol A, Bisphenol Z, hydrogenation bisphenol A, etc. can be raised.

[0186] moreover, as what has the structure of cross linkage as polyester resin A carboxylic acid, 1 and 2, trivalent [following], 4-benzene tricarboxylic acid, [for example,] 2, 5, 7-naphthalene tricarboxylic acid, 1 and 2, 4-naphthalene tricarboxylic acid, 1, 2, 4-butane tricarboxylic acid, 1 and 2, 5-hexane tricarboxylic acid, 1 A 3-dicarboxyl-2-methyl-2-methylene carboxy propane, 1, 2, 4-cyclohexane tricarboxylic acid, tetrapod (methylene carboxyl) methane, 1, 2, 7, 8-octane tetracarboxylic acid, pyromellitic acid, an en pole trimer acid, etc. are raised. On these acid anhydrides or a polyhydric-alcohol component, and a concrete target, a sorbitol, 1, 2, 3, 6-hexane tetrol, 1, 4-sorbitan, a pentaerythritol, Dipentaerythritol, tripentaerythritol, 1 and 2, 4-butane triol, 1, 2, 5-PENTA triol, a glycerol, isobutane triol, 2-methyl - It can also consider as bridge formation polyester resin by adding 1, 2, 4-butane triol, trimethylolethane, a trimethylol propane, 1 and 3, 5-trihydroxy methylbenzene, etc.

[0187] An inorganic pigment and an organic pigment can be mentioned as a coloring agent. As an inorganic pigment, a well-known thing can be used conventionally. A concrete inorganic pigment is illustrated below.

[0188] As a black pigment, magnetic powder, such as carbon black, such as furnace black, channel black, acetylene black, thermal black, and lamp black, and also a magnetite, and a ferrite, is also used, for example.

[0189] According to a request, it is possible independent or for these inorganic pigments to carry out the selection combined use of the plurality. Moreover, the addition of a pigment is two to 20 mass % to a polymer, and 3 - 15 mass % is chosen preferably.

[0190] In case it is used as a magnetic toner, the above-mentioned magnetite can be added. In this case, it is desirable to do 20-60 mass % addition of into a toner from a viewpoint which gives predetermined magnetic properties.

[0191] A thing conventionally well-known also as an organic pigment can be used. A concrete organic pigment is illustrated below.

[0192] As a pigment for a Magenta or red C. I. pigment red 2, C.I. pigment red 3, C.I. pigment red 5, C.I. pigment red 6, C.I. pigment red 7, C.I. pigment red 15, C.I. pigment red 16, and C.I. pigment red 48: 1, C.I. pigment red 53: 1, C.I. pigment red 57: 1, the C.I. pigment red 122, the C.I. pigment red 123, the C.I. pigment red 139, the C.I. pigment red 144, the C.I. pigment red 149, the C.I. pigment red 166, the C.I. pigment red 177, C. I. pigment red 178 and C.I. pigment red 222 grade are mentioned.

[0193] As a pigment for an orange or yellow, the C.I. pigment orange 31, the C.I. pigment orange 43, the C.I. pigment yellow 12, the C.I. pigment yellow 13, the C.I. pigment yellow 14, the C.I. pigment yellow 15, the C.I. pigment yellow 17, the C.I. pigment yellow 93, the C.I. pigment yellow 94, and C.I. pigment yellow 138 grade are

[0194] As a pigment for green or cyanogen, the C.I. pigment blue 15, the C.I. pigment blue 15:2, the C.I. pigment blue 15:3, the C.I. pigment blue 16, the C.I. pigment blue 60, and C.I. pigment green 7 grade are mentioned.

[0195] According to a request, it is possible independent or for these organic pigments to carry out the selection combined use of the plurality. Moreover, the addition of a pigment is two to 20 mass % to a polymer, and 3 - 15 mass % is chosen preferably.

[0196] It can also be used carrying out the surface treatment of the coloring agent. As the surface-treatment agent, a well-known thing can be used conventionally, and a silane coupling agent, a titanium coupling agent, an aluminum coupling agent, etc. can specifically use preferably.

[0197] The so-called external additive can be added and used for the toner obtained by this invention for the purpose, such as a fluid improvement and improvement in cleaning nature. In what is limited especially as these external additives, there is nothing and non-subtlety particles, various organic particles, and various lubricant can be used.

[0198] As a non-subtlety particle, a well-known thing can be used conventionally. Specifically, a silica, titanium, an alumina particle, etc. can use preferably. A thing hydrophobic as these inorganic particle is desirable. Specifically, the commercial elegance R-805 made from Japanese Aerosil, R-976, R-974, R-972, R-812, R-809, HVK-2150 by Hoechst A.G., H-200, commercial elegance TS-720 by Cabot Corp., TS-530, TS-610, H-5, and MS-5 grade are mentioned as a silica particle.

[0199] As a titanium particle, the commercial elegance T-805 of the product made from Japanese Aerosil for example, T-604, commercial elegance MT-100S by TAYCA CORP., MT-100B, MT-500BS, MT-600, MT-600SS, JA-1, commercial elegance TA-300SI by the Fuji titanium company, TA-500, TAF-130, TAF-510, TAF-510T, commercial Idemitsu Kosan elegance IT-S, IT-OA, IT-alumnus, IT-OC, etc. are mentioned.

[0200] As an alumina particle, commercial elegance RFY-C made from Japanese Aerosil, C-604, and the commercial elegance TTO-55 grade by Ishihara Sangyo Kaisha, Ltd. are mentioned, for example.

[0201] Moreover, as an organic particle, the diameter of a number-average primary particle can use the organic globular form particle which is about 10-2000nm. As this thing, homopolymers and these copolymers, such as styrene and methyl methacrylate, can be used.

[0202] The metal salt of higher fatty acids, such as salts, such as salts, such as salts, such as salts, such as salts, such as zinc of stearin acid, aluminum, copper, magnesium, and calcium, zinc of oleic acid, manganese, iron, copper, and magnesium, zinc of a palmitic acid, copper, magnesium, and calcium, zinc of linolic acid, and calcium, zinc of a ricinoleic acid, and calcium, is mentioned to lubricant.

[0203] The addition of these external additives has a desirable 0.1 - 5 mass % grade to a toner. A tonerized process may add the above-mentioned external additive for the purpose of performing improvement of a fluidity, electrification nature, and cleaning nature for the toner particle obtained above. As the addition method of an external additive, various well-known mixed equipments, such as the TURBULA mixer, a Henschel mixer, a NAUTA mixer, and a V shaped rotary mixer, can be used.

[0204] A toner may add the material which can give various functions as an additive for toners in addition to a binder resin and a coloring agent. Specifically, a release agent, an electric charge control agent, etc. are mentioned.

[0205] In addition, as a release agent, various is well-known and, specifically, amide system waxes, such as natural waxes, such as olefin system waxes, such as polypropylene and polyethylene, these denaturation objects and carnauba wax, and a rice wax, and a fatty-acid screw amide, etc. can be raised. These were added as a release agent particle and it was already said with the resin or the coloring agent that it is desirable a salting-out / to make it weld.

[0206] Similarly, also as for an electric charge control agent, various is well-known, and it can use what can be distributed underwater. Specifically, the metal salt of a Nigrosine system color, a naphthenic acid, or a higher fatty acid, an alkoxyl-ized amine, a quarternary-ammonium-salt compound, an azo system metal complex, a salicylic-acid metal salt, or its metal complex is mentioned.

[0207] <Developer> Although the toner used for this invention may be used as a two component developer also with a 1 component developer, it is as a two component developer preferably.

[0208] Although there is also a method of using the aforementioned toner as it is as a nonmagnetic 1 component developer when using as a 1 component developer, usually, into a toner particle, an about 0.1-5-micrometer magnetic particle is made to contain, and it uses as a magnetic 1 component developer. It is common to make it contain in a non-globular form particle like a coloring agent as the content method.

[0209] Moreover, it can mix with a carrier and can use as a two component developer. In this case, a well-known material is used as a magnetic particle of a carrier from the former, such as an alloy of metals, such as iron, a ferrite, and a magnetite, those metals, and metals, such as aluminum and lead. Especially a ferrite particle is desirable. As the volume mean particle diameter, 15-100 micrometers of 25-60-micrometer things of the above-mentioned magnetic particle are more preferably good.

[0210] Measurement of the volume mean particle diameter of a carrier can be typically measured by the laser diffraction formula particle-size-distribution measuring device "HEROSU (HELOS)" (sympathizer tick (SYMPATEC) company make) equipped with the wet disperser.

[0211] The so-called pitch powder type carrier of a carrier which distributed the magnetic particle in the thing by which the magnetic particle is further covered with the resin, or the resin is desirable. As resin composition for coating, although there is especially no limitation, an olefin system resin, a styrene resin, a styrene-acrylic resin, a silicone system resin, an ester system resin, or a fluorine content polymerization system resin is used, for example. Moreover, especially as a resin for constituting a pitch

powder type carrier, it cannot be limited, a well-known thing can be used, for example, styrene acrylic resin, polyester resin, a fluorine system resin, phenol resin, etc. can be used.

[0212] Drawing 1 is the outline block diagram showing the composition of the whole image formation equipment of this invention. The image formation equipment shown in drawing 1 is image formation equipment by the digital method, and consists of picture read station A, the image-processing section B (illustration abbreviation), the image formation section C, and the transfer-paper conveyance section D as a transfer-paper conveyance means.

[0213] The automatic manuscript informer stage which conveys a manuscript automatically is established in the upper part of picture read station A, one-sheet ***** conveyance of the manuscript laid on the manuscript installation base 11 is carried out with the manuscript conveyance roller 12, and reading of a picture is performed in reading position 13a. The manuscript which manuscript reading ended is discharged on the manuscript delivery pan 14 with the manuscript conveyance roller 12.

[0214] On the other hand, the picture of the manuscript at the time of being placed on platen glass 13 is read by movement by speed $v/2$ to this direction of the 2nd mirror unit 16 which consists of reading operation by the speed v of the 1st mirror unit 15 which consists of the lighting lamp and the 1st mirror which constitute scanning optical system, and the 2nd mirror and the 3rd mirror located in the shape of V character.

[0215] Image formation of the read picture is carried out to the light-receiving side of the image pck-up element CCD which is a line sensor through the projection lens 17. After it performs A/D conversion after photo electric translation of the optical image of the shape of a line by which image formation was carried out on the image pck-up element CCD was carried out to the electrical signal (luminance signal) one by one, and processing of concentration conversion, filtering, etc. is performed in the image-processing section B, image data is once memorized by memory.

[0216] In the image formation section C, the electrification machine 22 which is an electrification means, the developer 23 which is a development means, the imprint machine 24 which is an imprint means, the eliminator 25 which is a separation means, the cleaning means 26, and PCL (precharge lamp) 27 are respectively arranged in order of operation as an image formation unit at the photo conductor (henceforth a photo conductor drum) 21 and periphery of the shape of a drum which is an image support. It is what carried out application formation of the photoconductivity compound on the drum base, for example, an organic photo conductor (OPC) is used preferably, and drive rotation of the photo conductor 21 is carried out at the clockwise rotation of illustration.

[0217] After uniform electrification with the electrification machine 22 is made to the rotating photo conductor 21, image exposure based on the picture signal called from the memory of the image-processing section B by the exposure optical system 30 is performed. the exposure optical system 30 which is a write-in means should use as the luminescence light source laser diode which is not illustrated, and should pass the rotating polygon mirror 31 and ftheta lens (with no sign), and a cylindrical lens (with no sign) -- an optical path is bent by the reflective mirror 32, horizontal scanning is made, image exposure is performed in the position of Ao to a photo conductor 21, and a latent image is formed of rotation (vertical scanning) of a photo conductor 21 With an example of the form of this operation, it exposes to the character section and a latent image is formed.

[0218] Reversal development is performed by the developer 23 and, as for the latent image on a photo conductor 21, the toner image of a visible image is formed in the front face of a photo conductor 21 of it. The feed unit 41 as a transfer-paper receipt means by which the transfer paper P of different size under the image formation unit was contained in the transfer-paper conveyance section D (A), 41 (B) and 41 (C) are prepared and the manual paper feed unit 42 which performs a manual paper feed is formed in the side. Paper is fed to the transfer paper P chosen from those either by the guide roller 43 along the conveyance way 40. Re-feeding is performed by 44 after a transfer paper P halts. the resist roller pair which makes the correction of the inclination of a transfer paper, and a bias to which paper is fed -- It shows around at the conveyance way 40, front [imprint] roller 43a, and the imprint penetration guide plate 46. The toner picture on a photo conductor 21 is imprinted by the transfer paper P with the imprint vessel 24 in the imprint position Bo, and, subsequently electricity is discharged by the eliminator 25, and

it dissociates from the 21st page of a photo conductor, and a transfer paper P is conveyed by the fixing assembly 50 by the transport device 45.

[0219] The fixing assembly 50 has the fixing roller 51 and the pressurization roller 52, heats a transfer paper P by passing between the fixing roller 51 and the pressurization rollers 52, and heats ** arrival of the toner by pressurization. The transfer paper P which finished fixing of a toner picture is discharged on the delivery tray 64.

[0220] Drawing 2 is the front view showing the photo conductor in the image formation equipment of this invention, and the composition of the circumference of it. In drawing 2, in order that 21 may heat a photo conductor and 71 may heat a photo conductor 21, the heater as a heating element prepared in inner skin and 72 are the temperature sensors as a temperature detection means to detect the photo conductor temperature prepared in the periphery of a photo conductor by contacting or approaching.

[0221] In drawing 2, it is equivalent to time for a photo conductor to move the distance from the exposing [image] point Ao point of a photo conductor to the development start point Ds with time until development is started in the following development process after image exposure at the image exposure process of this invention. Moreover, as shown in drawing 1 mentioned above, the environmental condition detection means 73 for detecting the environmental condition of the environment where this image formation equipment is installed is formed in the image formation equipment of this invention. This environmental condition detection means 73 consists of a temperature sensor 731 for detecting environmental temperature, and a humidity sensor 732 for detecting environmental humidity.

[0222]

[Example] Although an example is given and this invention is explained in detail hereafter, the aspect of this invention is not limited to this. In addition, the "mass section" is expressed as the "section" among a sentence.

[0223] production of one to examples 1-3 and example of comparison 3 photo conductor 1 -- the photo conductor 1 was produced as follows

[0224]

<Under-coating layer> Titanium chelate compound (product made from TC-750 Matsumoto Pharmaceuticals) 30g Silane coupling agent (KBM-503 Shin-etsu chemistry company make) 17g 2-propanol It applied so that it might become 0.5 micrometers of dryness thickness on the conductive base material of a phi60mm cylindrical shape using the 150ml above-mentioned application liquid.

[0225]

<Charge generating layer> Y type titanylphthalocyanine (the maximum peak angle of the X diffraction by the Cu-Kalpha characteristic X ray is 27.3 at 2theta) 60g Silicone denaturation butyral resin (X-40-1211M:Shin-etsu chemistry company make)

700g t-butanol 1600ml 2-methoxymethyl pentanone 400ml was mixed, it distributed for 10 hours using the sand mill, and charge generating layer application liquid was prepared. This application liquid was applied by the dip painting cloth method on the aforementioned under-coating layer, and the charge generating layer of 0.2 micrometers of dryness thickness was formed.

[0226]

<Charge transporting bed> Charge transportation matter (T-18) 200g Polycarbonate (Z-300:Mitsubishi Gas Chemical Co., Inc. make) 300g Antioxidant (instantiation compound 1-3) 5g Dichloromethane 2000ml was mixed, it dissolved and charge transporting-bed application liquid was prepared. This application liquid was applied by the dip painting cloth method on the aforementioned charge generating layer, and the charge transporting bed of 20 micrometers of dryness thickness given in Table 1 was formed. The ionization potential of a charge transporting bed was 5.40 (eV).

[0227]

<Hardenability resin layer> Methyl trimetoxysilane 180g Compound (instantiation compound B-1) 60g Antioxidant (instantiation compound 2-1) 1g 2-propanol 225g 3% acetic acid 30g Aluminum tris acetylacetonato 3g methyl trimetoxysilane, dimethoxy dimethylsilane, 2-propanol, and 3% acetic acid were mixed, it agitated at the room temperature for 16 hours, and the oligomer liquid of a silane compound was prepared. Subsequently, after adding the instantiation compound T-1, an antioxidant, and

aluminum tris acetylacetonato to this oligomerization liquid and agitating for 2 hours, it filtered and the application liquid for hardenability resin layers was adjusted. The hardenability resin layer of 2.5 micrometers of dryness thickness was formed for this application liquid by the circular amount regulation type coater on the aforementioned charge transporting bed, 110 degrees C and heat hardening of 1 hour were performed, the siloxane system resin layer which has the structure of cross linkage was formed, and the photo conductor 1 was produced. The ionization potential of a hardenability resin layer was 5.51 (eV). Therefore, the ionization potential difference of the hardenability resin layer of a photo conductor 1 and a charge transporting bed is 0.11 (eV).

[0228] In the production photo conductor 1 of a photo conductor 2, the hardenability resin layer was changed as follows, and the photo conductor 2 was produced.

[0229]

<Hardenability resin layer> Methyl trimetoxysilane 100g Dimethoxy dimethylsilane 82g Instantiation compound (B-1) 60g Antioxidant (instantiation compound 2-1) 1g 2-propanol 225g 3% acetic acid 30g Dibutyl tin acetate After adding simultaneously 3g methyl trimetoxysilane, dimethoxy dimethylsilane, 2-propanol, 3% acetic acid, the instantiation compound T-1, an antioxidant, and aluminum tris acetylacetonato and agitating them for 2 hours, it filtered and the application liquid for hardenability resin layers was adjusted. The hardenability resin layer of 2.5 micrometers of dryness thickness was formed for this application liquid by the circular amount regulation type coater on the aforementioned charge transporting bed, 110 degrees C and heat hardening of 1 hour were performed, the siloxane system resin layer which has the structure of cross linkage was formed, and the photo conductor 2 was produced. The ionization potential of this hardenability resin layer was 5.62 (eV). Therefore, the ionization potential difference of the hardenability resin layer of a photo conductor 2 and a charge transporting bed is 0.22 (eV).

[0230] In the production photo conductor 1 of a photo conductor 3, the charge transporting bed was changed as follows, and the photo conductor 3 was produced.

[0231]

<Charge transporting bed> Charge transportation matter (T-20) 200g Polycarbonate (Z-300:Mitsubishi Gas Chemical Co., Inc. make) 300g Antioxidant (instantiation compound 1-3) 5g Dichloromethane 2000ml was mixed, it dissolved and charge transporting-bed application liquid was prepared. This application liquid was applied by the dip painting cloth method on the aforementioned charge generating layer, and the charge transporting bed of 20 micrometers of dryness thickness was formed.

[0232] The ionization potential of a charge transporting bed was 5.60 (eV). Since the hardenability resin layer installed the same hardenability resin layer as a photo conductor 1, the ionization potential difference was 0.09 (eV).

[0233] In the production photo conductor 1 of a photo conductor 4, the charge transporting bed was changed as follows, and the photo conductor 4 was produced.

[0234]

<Charge transporting bed> Charge transportation matter (T-16) 200g Polycarbonate (Z-300:Mitsubishi Gas Chemical Co., Inc. make) 300g Antioxidant (1-3) 5g Dichloromethane 2000ml was mixed, it dissolved and charge transporting-bed application liquid was prepared. This application liquid was applied by the dip painting cloth method on the aforementioned charge generating layer, and the charge transporting bed of 20 micrometers of dryness thickness was formed.

[0235] The ionization potential of a charge transporting bed was 5.05 (eV). Since the hardenability resin layer was installed like the photo conductor 1, the ionization potential difference was 0.46 (eV).

[0236] Even the charge transporting bed was formed like the production photo conductor 1 of a photo conductor 5.

[0237]

<Hardenability resin layer> Methyl trimetoxysilane 180g Compound (instantiation compound B-8) 60g Antioxidant (instantiation compound 2-1) 1g 2-propanol 225g 3% acetic acid 30g Aluminum tris acetylacetonato These were mixed 3g, it stirred at the room temperature for 16 hours, and the oligomer liquid of a silane compound was prepared. Subsequently, after adding the instantiation compound B-12

of this oligomerization liquid, an antioxidant, and aluminum tris acetylacetonato and stirring for 2 hours, it filtered and the application liquid for hardenability resin layers was adjusted. The hardenability resin layer of 2.5 micrometers of dryness thickness was formed for this application liquid by the circular amount regulation type coater on the aforementioned charge transporting bed, 110 degrees C and heat hardening of 1 hour were performed, the siloxane system resin layer which has the structure of cross linkage was formed, and the photo conductor 5 was produced. The ionization potential of a hardenability resin layer was 4.98 (eV). Therefore, the ionization potential difference of the hardenability resin layer of a photo conductor 5 and a charge transporting bed is 0.42 (eV).

[0238] production styrene [of the production developer 1 of a developer]: -- butyl acrylate: -- pulverizing was performed using the mechanical grinder and the styrene-acrylic resin 100 section which consists of a mass ratio of butyl methacrylate =75:20:5, the carbon black 10 section, and the low-molecular-weight-polypropylene (number average molecular weight 3500) 4 section were classified twice with the pneumatic elutriation machine, after kneading, melting and 1.2 mass % was added for the hydrophobic silica (12nm of diameters of the 75/number-average primary particle of the degrees of hydrophobing) to this coloring particle, the peripheral speed of a Henschel mixer was mixed for 10 minutes at 40 m/s and 50 degrees C, and the toner 1 was obtained. The rate (piece several %) of 7.3 micrometers and shape factors 1.0-1.6 of the number mean particle diameter of this toner 1 was 68.0.

[0239] The ferrite carrier of 45 micrometers of volume mean particle diameters which covered silicone resin was mixed to this toner, and the developer 1 of 6% of toner concentration was adjusted to it.

[0240] In addition, measurement of the number mean particle diameter of a carrier was measured by laser diffraction formula particle-size-distribution measurement neglect "HEROSU (HELOS)" (sympathizer tick company make).

[0241] 0.90kg of production n-sodium dodecyl sulfates of a developer 2 and pure water 10L are put in, and the churning dissolution is carried out. 330R(carbon black by Cabot Corp.) 1.2kg of legal one was gradually added to this liquid under churning, and, subsequently continuation distribution was carried out for 20 hours using the Sand grinder (medium disperser). after distribution and Otsuka electronic company make -- as a result of measuring the particle size of the above-mentioned dispersion liquid using electrophoresis light-scattering-photometer ELS-800, it was 122nm in weighted-mean particle size. Moreover, the solid-content concentration of the above-mentioned dispersion liquid measured by the weighting method by gentle placement dryness was 16.6 mass %. Let these dispersion liquid be "coloring agent dispersion liquid 1."

[0242] 0.055kg of sodium dodecylbenzenesulfonate is mixed to ion-exchange-water 4L, and the churning-under room temperature dissolution is carried out. Let this be the anionic surface active agent solution A.

[0243] Nonyl-phenol alkyl ether 0.014kg is mixed to ion-exchange-water 12L, and the churning-under room temperature dissolution is carried out. This is called initiator solution A.

[0244] Number average molecular weight (Mn) puts polypropylene emulsion 3.41kg of 3500, the anionic surface active agent solution A, and the nonionic-surface-active-agent solution A into the reaction iron pot of 100L which attached a thermo sensor, a cooling pipe, and nitrogen introduction equipment, and churning is started. Subsequently, ion-exchange-water 44L is added.

[0245] Heating is started and whole-quantity addition of the initiator solution A is carried out in the place where the degree of solution temperature became 75 degrees C. Styrene 12.1kg, acrylic-acid n-butyl 2.88kg, and 1.04kg of methacrylic acids and t-dodecyl-mercaptan 548g are supplied controlling the degree of solution temperature at 75**1 degree C after that.

[0246] Furthermore, the degree of solution temperature was lowered to 80 degrees C **1 degree C, and heating churning was performed for 6 hours. The degree of solution temperature is cooled at 40 degrees C or less, and churning is stopped. It filtered with the pole filter and this was made into the latex A1.

[0247] In addition, the glass transition temperature of the resin particle in a latex A1 was [weight average molecular weight 12,700 and the weighted-mean particle size of 57 degrees C, the softening temperature of 121 degrees C, and molecular weight distribution] 120nm.

[0248] 200.7g of potassium persulfate is mixed to ion-exchange-water 12L, and the churning-under

room temperature dissolution is carried out. Let this be the initiator solution B.

[0249] The nonionic-surface-active-agent solution A is put into the reaction iron pot of 100L which attached the thermo sensor, the cooling pipe, the nitrogen introduction pipe, and the tandem-type baffle, and churning is started. Subsequently, ion-exchange-water 44L is supplied.

[0250] Heating is started and the initiator solution B is added in the place where the degree of solution temperature became 70 degrees C. At this time, the solution which mixed beforehand styrene 11kg, acrylic-acid n-butyl 4kg, and 1.04kg of methacrylic acids and t-dodecyl-mercaptan 9.02g is thrown in.

[0251] Then, the degree of solution temperature was controlled at 72 ± 2 degrees C, and heating churning was performed for 6 hours. Furthermore, the degree of solution temperature was raised to 80 ± 2 degrees C, and heating churning was performed for 12 hours. Subsequently, the degree of solution temperature is cooled at 40 degrees C or less, and churning is stopped. It filtered with the pole filter and this filtrate was made into the latex B1. In addition, for the glass transition temperature of the resin particle of a latex B1, 58 degrees C and softening temperature were [weight-average-molecular-weight 245,000 and the weighted-mean particle size of 132 degrees C and molecular weight distribution] 110nm.

[0252] 5.36kg of sodium chlorides as salting agent and ion-exchange-water 20L are put in, and the churning dissolution is carried out. Let this be the sodium chloride solution A.

[0253] In the SUS reaction iron pot (impellers are support wings) of 100L which attached a thermo sensor, a cooling pipe, nitrogen introduction equipment, and the tandem-type baffle, 20kg of ion exchange water is put in with the latex A1, 20kg and the latex B1, and 5.2kg and 1 or 0.4kg of coloring agent dispersion liquid produced above, and it agitates. Subsequently, it warms at 35 degrees C and the sodium chloride solution A is added. After leaving it for 5 minutes after that, a temperature up is started, and the temperature up of the degree of solution temperature is carried out in 5 minutes to 85 degrees C. (A part for 10 degrees-C/of programming rates) Heating churning is carried out with the degree of solution temperature of 85 ± 2 degrees C for 6 hours, and a salting-out and weld of are done. It cools at 30 degrees C or less after that, and churning is stopped. It filters with the sieve of 45 micrometers of openings, and let this filtrate be meeting liquid (1). Subsequently, the centrifugal separator was used and the wet cake-like non-globular form-like particle was separated from meeting liquid (1). Ion exchange water washed after that.

[0254] The coloring particle of the shape of a wet cake which completed washing above was dried by 40-degree C warm air, and the coloring particle was obtained. The number mean particle diameter of this coloring particle was 4.6 micrometers. Furthermore, hydrophobic silica (degree 65 of hydrophobing, 12nm of diameters of number-average primary particle) 1 mass % was added to this coloring particle, the peripheral speed of a Henschel mixer was mixed for 10 minutes at 20 m/s and 41 degrees C, and the toner 2 was obtained. The rate (piece several %) of 4.6 micrometers and shape factors 1.0-1.6 of the number mean particle diameter of this toner particle was 81.1.

[0255] The ferrite carrier of 45 micrometers of volume mean particle diameters which covered silicone resin like the developer 1 was mixed using this toner 2, and the developer -2 of 6% of toner concentration was adjusted.

[0256] <Evaluation> Time-response nature evaluation of the time-response nature (T10) evaluation photo conductor of 1. photo conductor was performed using photo conductor testing-device EPA-8100 (the Kawaguchi electrical machinery company make).

[0257] The produced drum was cut down to plate-like [of about 5x5 (cm)], and the tester was equipped, it set up so that it might become the electrification potential -600 ± 20 (V) in the static mode, and light exposure was set as sufficient quantity of light which the surface potential of a photo conductor becomes below -200 (V) in the white light, and measured the surface potential after optical irradiation at intervals of 10msec. The time T10 until the ten-point average of the difference of the surface potential measured in time to adjoin each other after optical irradiation becomes less than [10V] as a speed of response was found.

[0258] 2. Picture evaluation (example 1 - examples 1-3 of 3 comparison were performed to [Table 1] in photo conductor of publication, and combination of developer.)

Characterization is the digital copier Konica7075 (laser exposure) by Konica Corp. about this photo conductor. It carries in 75 sheets of A4 papers copying machine reconstruction machine for /which has reversal development, presser-foot-stitch-tongue separation, and a blade cleaning process. Adjust photo conductor linear velocity and the time between image exposure process-development processes is set as 120msec(s). Initial electrification potential was set as -750V, and picture evaluation of a continuation copy of 30,000 sheets of A4 papers was performed, respectively in low-humidity/temperature environmental:LL (10 degrees C, 20%RH) and high-humidity/temperature environment:HH (30 degrees C, 80%RH).

[0259] Picture evaluation carried out visual evaluation of the original picture which changes image exposure of dot density 400dpi to 3200, 1900, and 800 (micrometer²), and has [exposure] the character picture whose rate of a pixel is 7%, a person photograph of his face, a solid white picture, and a solid black picture in 1/4 division into equal parts in laser-beam spot area, respectively.

[0260] Evaluation process conditions, in addition the picture evaluation conditions using the above 7075 were set as the following conditions.

[0261] Electrification condition electrification machine; A scorotron electrification machine, initial electrification potential -750V development condition DC bias ; -500VDsd(photo conductor and distance between development sleeves);600-micrometer developer layer regulation ; Magnetic H-Cut method developer thickness ; diameter of 700-micrometer development sleeve; -- 40mm imprint condition imprint pole; -- a corona-electrical-charging method -- imprint dummy current-value: -- 45microA cleaning condition elastic body rubber blade; -- free length: -- 9mm Thickness : It grows fat in 2mm, degree-of-hardness:70 degree, impact resilience:35, and O:dot picture by which the photo conductor contact pressure (linear pressure):15 g/cm picture property dot picture quality evaluation O:dot picture is reproduced almost faithfully. becoming thin -- disorder of x:dot picture which **:dot picture currently reproduced vividly deteriorated with copy number of sheets although it was, and character dust has generated, and intense [0262] which is carrying out character dust generating

[Table 1]

実施例 比較例 No.	感光体 No.	応答性 (T ₁₀) (sec)	現像剤 No.	画像評価					
				スポット面積(μm ²)					
				3200		1900		800	
				HH	LL	HH	LL	HH	LL
実施例 1	1	0.05	1	○	○	○	○	◎	◎
実施例 2	1	0.05	2	○	○	◎	◎	◎	◎
実施例 3	2	0.16	1	△	○	○	○	◎	○
比較例 1	3	0.30	1	△	×	△	×	×	×
比較例 2	4	0.20	1	×	×	×	×	×	×
比較例 3	5	0.14	1	×	△	×	×	×	×

[0263] It evaluated like the example 1 except having changed the time between image exposure process-development processes into 90msec(s) from 120msec(s) in example 4 example 1.

[0264] It evaluated like the example 1 of comparison except having changed the time between image exposure process-development processes into 90msec(s) from 120msec(s) in the example 1 of example of comparison 4 comparison.

[0265]

[Table 2]

実施例 比較例 No.	感光体 No.	応答性 (T ₁₀) (sec)	現像剤 No.	画像評価					
				スポット面積(μm ²)					
				3200		1900		800	
				HH	LL	HH	LL	HH	LL
実施例 4	1	0.05	1	○	○	○	○	◎	◎
比較例 4	3	0.20	1	×	×	×	×	×	×

[0266] The time between image exposure process-development processes is a book at 100 or less msec.

[0267] As for the examples 1-3 of comparison for which the difference of this ionization potential exceeded 0.4, the dot picture has deteriorated to the photo conductor of the examples 1-3 whose differences of the ionization potential of the hardenability resin layer of this invention and a charge transporting bed are below 0.4 (eV) so that clearly from the evaluation table 1 having the formed good dot picture. Moreover, it is found out in the image [area / spot] exposure using 2000 or less beam light that picture quality is more good. And by comparison of the example 4 of Table 2, and the example 4 of comparison, the time from exposure to development sets to the image formation method of 100 or less msec, and it is a book.

[0268]

[Effect of the Invention] From the above-mentioned example, also in the severe conditions under low-humidity/temperature environment or a high-humidity/temperature environment, the electrophotography photo conductor which has the photosensitive layer and hardenability resin layer of this invention forms a good dot picture, and shows the effect which was excellent also in the image formation method and image formation equipment using this photo conductor.

[Translation done.]